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OCTOBER, 1934 NUMBER 292

THE UNIVERSITY OF NORTH CAROLINA RECORD

RESEARCH IN PROGRESS

JULY, 1933—OCTOBER, 1934

GRADUATE SCHOOL SERIES No. 28

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FOREWORD

The present issue of Research in Progress is the fourteenth volume of this publication. It contains the record and summary analysis of investigations carried on by students and faculty of the University of North Carolina during a period of fifteen months ending September 1, 1934.

W. W. Pierson, Jr., *Dean*

244799

APPROPRIATIONS GRANTED FROM THE SMITH RESEARCH FUND

PROJECT NO.	APPLICANT	SUBJECT	AMOUNT
215	Russell, H. K.	For traveling expenses to Washington to examine the Library of Congress copy of *Pathomachia* in connection with an article he is preparing	$ 15.00
216	Pierson, W. W.	For the purchase of San Pedro's *Legislación Ultramarina*	14.00
217	MacNider, William deB.	For traveling expenses to consult libraries in Washington, New York, and Philadelphia	50.00
218	Holmes, U. T. Jr.	To purchase Photostat of British Museum MS Sloane 3525	50.00
219	Coker, W. C.	To purchase *The Ferns of North America*, by D. C. Eaton, 1879	40.00
220	N. B. Adams, A. K. Shields, S. E. Leavitt, S. A. Stoudemire	To purchase a complete set of El Seminario Pintoresco Español, 1836-1857	26.00
221	Taylor, G. C.	To purchase two books to be used in his Milton research	15.29
222	MacKinney, L. C.	To purchase *Macer Floridus*, edited by Choulant, in connection with his research in medieval medicine	12.65
223	Boggs, Ralph S.	To purchase photostats and photographs in connection with two research projects	10.00
224	Prouty, W. F.	To aid in carrying on research in arenaceous *foraminifera*	25.00
225	Henry, N. H.	For traveling expenses to Washington in connection with his research in Milton	15.00
226	Ericson, E. E.	For traveling expenses to New York and Philadelphia in connection with his bibliography of homage volume literature	30.00
227	Carroll, J. E., Jr.	To purchase photostats and books necessary for the completion of his doctoral dissertation on Cleópatre in French literature	32.00
228	Linker, R. W.	To purchase photostats and books necessary in the preparation of an edition of works of Peire de Corbiac	50.00
229	Morgan, E. C.	For aid in traveling expenses to London and Dublin to consult libraries for material on the politics of Joseph Addison	100.00
230	Pierson, W. W.	To purchase the works of Francisco Arango and the complete works of Martí	46.80
231	Harland, J. P.	To secure material for a course in Greek Epigraphy and for books and slides of important and typical inscriptions	30.00
232	Hunter, E. C.	To purchase standard test materials and to pay for the scoring of tests after they are given, in connection with his doctoral research	100.00
233	Metzenthin, E. C.	To enable him to consult MSS of the ninth century in libraries in Germany in connection with his research on Old High German MSS	60.00
234	Dey, W. M. (For the Department of Romance Languages)	To aid in the publication of the first volume of Du Bartas: (a) to defray one-half the cost of lithoprinting, $200; or (b) if volume is printed by University press, $300.	200.00 or 300.00
235	Hagood, M. J.	For traveling expenses to Washington and Cambridge in connection with his doctoral research	50.00
236	Russell, J. C.	For securing photostats ($25.00) and to supplement his grant from the American Council of Learned Societies for study in England ($75.00)	100.00
237	Mahler, A. J.	For traveling expenses to Cambridge, for work on doctoral dissertation	50.00
238	Taylor, Cecil G.	For aid in traveling expenses to Paris for work on his doctoral dissertation	100.00
239	Crockford, H. D.	For expenses on a one-day trip from New York to Boston for research work	9.50
240	Bond, R. P.	For photostats, $50.00; for traveling expenses to Washington and New York for work on his Addison research project, $50.00	100.00
241	Johnson, W. H. E.	For aid on traveling expenses to Russia for work on his doctoral dissertation	125.00
242	Frazer, K. C.	For photostats and copies of the MSS correspondence of Senator Morgan	90.00

PROJECT NO.	APPLICANT	SUBJECT	AMOUNT
243	Williams, Arnold	To purchase a rare book and to secure photostats in connection with his research	27.00
244	Leavitt, S. E.	To purchase cards and a filing cabinet to be used for check-list of some 12,000 Spanish plays recently acquired by the library	50.00
245	Wheeler, A. S.	For the purification of 5,000 grams of 1,5-dihydroxynapthalene, in order to have pure material for research purposes	60.00
246	MacNider, William deB.	For traveling expenses to Washington and to secure certain microphotographs	86.00
247	Hamilton, J. G. deR.	To purchase a camera for the use of the Southern Historical Collection	23.75
248	Prouty, W. F.	To purchase microscopic photographs and silurian ostracods and to make microscopic mounts	50.00

APPROPRIATIONS FROM THE ROCKEFELLER FUND FOR RESEARCH IN PURE SCIENCE, 1933-1934

APPLICANT	SUBJECT	AMOUNT
Frank K. Cameron	For purchase and installation of a 3-unit motor generator set to furnish constant voltage for x-ray equipment	$ 606.60
R. E. Coker	For constant temperature apparatus, technical assistance, and other supplies for continuation of experimental studies on copepods	800.00
T. F. Hickerson	For publication by the University Press of his volume on "Structural Frameworks—A New Method of Analysis"	800.00
C. D. Beers	For study of the so-called silver line system in the ciliate Blepharisma	100.00
A. S. Wheeler and H. D. Crockford	For purchase of a hydrogen ion clorimeter of the Klett-Beaver type to be used in a study of the new indicator cymyl-orange	92.00
J. N. Couch	To pay for technical assistance in photographing and culturing Septobasidium and other fungi	272.27
R. W. Bost	For purchase of ultra-violet lamp for use in studying the stability of several classes of sulfur compounds toward certain refining reagents	30.00
A. S. Wheeler	For purchase of Monobromodinitrodihydroxynaphthalene to complete a research on the nitration of dibromodihydroxynaphthalene	60.00
H. D. Crockford	For purchase of heavy water ($60); repair to research balance ($50); photographing of infra-red spectra during the passage of the electric current through electrolytic solutions	155.00
H. M. Burlage and M. L. Jacobs	For purchase of a preheater for the purification of oxygen	65.00
E. K. Plyler	For purchase of materials to study heavy water ($291.50); HCl windows ($50); technical assistance ($150)	491.50
R. M. Trimble and T. P. Noe	For purchase of a Huggenberger Tensometer and accessories	112.69
Gerald R. MacCarthy	Expenses in making a geophysical survey of the coastal plain and "meteor craters"	200.00
W. F. Prouty	For study of the Silurian system of southeastern Tennessee	150.00
University of North Carolina Press	Publication of special, large memorial issue of the Journal of the Elisha Mitchell Scientific Society	1,000.00
Otto Stuhlman	For purchase of one liter of neon ($16); technical assistance in work on cause of harmonic overtones in high frequency oscillators ($20)	36.00
W. F. Prouty	For geophysical research on origin of "meteor craters" in the coastal plain	50.00
H. M. Burlage	For gathering and for express on 100 lbs. of *Chrysopsis graminifolia* from lower South Carolina for experimentation for medicinal purposes	21.50
	TOTAL	$5,042.56

Part I

RESEARCH IN PROGRESS

DEPARTMENT OF ANATOMY

The following investigations are under way in the department:

W. C. George:

The Role of Blood Cells in Excretion in Ascidians.

A Comparative Study of Ascidian Blood.

Contact as a Stimulus to Localized Growth.

J. W. Culbertson and W. C. George.

The Structure of Nucleoli in Ascidian Oocytes.

J. U. Gunter. The Anatomy of Veins. Presented before the Elisha Mitchell Scientific Society, March 13, 1934.

For abstract see *Proceedings of the Mitchell Society,* p. 106.

DEPARTMENT OF BOTANY

W. C. Coker and H. R. Totten have published:

Trees of the Southeastern States. 399 pp., 232 drawings, 3 pls. Chapel Hill: The University of North Carolina Press. 1934.

They are working on another edition of this book to cover three more states, Tennessee, Kentucky, and West Virginia. This is expected to be out in a few months.

Work on the Shrubs of the Southeastern States, a companion volume to the Trees above mentioned, is progressing satisfactorily.

W. C. Coker (with Alma Holland) is bringing to completion the monograph on the *Boletaceae* which has been in progress for several years. This will include photographs and paintings.

John N. Couch has published:

Basidia of *Septobasidium* (*Glenospora*) *Curtisii. Journal of the Elisha Mitchell Scientific Society,* XLIX: 156-162, pls. 10, 11. 1933.

Professor Couch has had accepted for publication:

New or Little Known Chytridiales. *Mycologia,* 27.

This paper describes, giving cytological details, the life histories of three new parasitic fungi.

Work on the monograph of *Septobasidium* is being continued.

The following master's theses were accepted by the Department during the year:

RUTH SCHOLZ. Studies on the Leguminosae of North Carolina. (Under the direction of W. C. COKER and H. R. TOTTEN.)

Part I concerns several species of legumes with diverse forms and varieties or peculiarities not heretofore recorded. In *Gleditsia triacanthos* L. a few of the staminate flowers may have a fertile pistil which bears fruit. In the so-called "perfect flowers," the stamens bear sterile pollen grains. *Lupinus villosus* Willd. and *Lupinus diffusus* Nutt. are described and distinguished. We find for the first time that *Clitoria mariana* (L.) Small has glutinous seeds, a remarkable character unknown in any other North Carolina legume. *Stylosanthes biflora* (L.) B.S.P. and *S. riparia* Kearney are distinguished by the floral bracts. In Lespedeza a new variety, and in Vicia a new form and a new variety have been described. Lists of the native and naturalized legumes of North Carolina complete Part I.

Part II is a study of the seed development of *Strophostyles umbellata* (Muhl.) Britton. Microsporogenesis and megasporogenesis are described and drawn. In the development of the embryo the free endosperm nuclei and the endosperm cells are used up. The outer integument becomes the seed coat. The cotyledons, plumule, and radicle comprise the remainder of the seed.

BUDD ELMON SMITH. A Taxonomic and Morphological Study of the genus *Cuscuta,* Dodders, in North Carolina. (Under the direction of W. C. COKER.)

A taxonomic study was made of the seven species of *Cuscuta* occurring in North Carolina. The seed development of *C. arvensis, C. indecora, C. rostrata, C. compacta,* and *C. Gronovii* is described. Interesting structures are recorded, showing that the genus is peculiar for parasites and even for angiosperms. The development of the pollen grain is as usual among the angiosperms.

DEPARTMENT OF CHEMISTRY

A. S. WHEELER directed the following researches.

J. N. LECONTE. (Doctoral dissertation.) Some Quinoline Derivatives of 2-Amino-p-cymene.

A mixture of aminocymene and nitrocymene was subjected to Cohn-Gustavson's method for making quinolines. Product, 5-isopropyl-8-methylquinoline, yellow oil, b. at 230°-32° at 190 mm. Reduced by sodium and alcohol to 1,2,3,4-tetrahydro-5-isopropyl-8-methylquinoline, pale yellow oil, b. at 165°-167° at 27 mm. The condensation of aminocymene with paraldehyde gave 2,8-dimethyl-5-isopropylquinoline, white plates, m.78.° Reduced with sodium and alcohol it gave 1,2,3,4-tetrahydro-2,8-dimethyl-5-isopropylquinoline, white rhombic plates, m.65.° Aminocymene and acetylacetone condensed to form acetylacetocymidide, pale yellow oil, b. 184°-5° at 22 mm. This, when dehydrated with sulfuric acid, formed 2,4,6-trimethyl-5-isopropylquinoline, a yellow

oil, b. 177°-8° at 22 mm. Ethylacetoacetate condensed with aminocymene at high temperature to form acetoacetocymidide, long white needles, m.235.° This on dehydration formed 2-hydroxy-4,8-dimethyl-5-isopropylquinoline, short white needles, m.228°-30.° A cymyl isatine was formed, orange brown plates, m.174.° This compound failed to form cymyl atophan. Reactions of the above compounds with picric acid, methyl iodide and chloroplatinic acid were studied, and a number of derivatives were obtained. Substituents in position 8 prevented these quinolines from forming methyl iodide addition compounds.

A. P. SLEDD (Progress on doctoral dissertation.) The Fitting Condensation Applied to 2-Bromo-p-cymene with Aliphatic Bromides.

2-Bromo-p-cymene was condensed with n-propylbromide. The product gave a sulfonic acid, colorless needles, containing 4 molecules of water of crystallization. Copper salt, glistening blue needles, containing $8H_2O$. Sulfonic chloride, rectangular plates, m.71.° Sulfonamide, yellow rectangular plates, m.60.°

G. C. KYKER. (Progress on master's thesis.) The Constitution of Certain Halogen Derivatives of 2-Amino-6-nitro-p-cymene.

W. B. RICHARDSON (Progress on master's thesis.) The Nitration of 1, 5-Dihydroxynaphthalene.

After purifying a quantity of dihydroxynaphthalene it was acetylated with acetic anhydride, catalyzed by pyridine. The colorless diacetate was nitrated with conc. nitric acid at 18°-20.° Yellow crystals, m.170.° This product was hydrolyzed with alcoholic hydrochloric acid. Reddish crystals, m. 240° with decomposition. Acetylation of the nitro product gave a very pale compound, m.189° with decomposition. The sodium salt of the nitro compound forms an orange powder.

C. A. PIGOTT. (Progress on master's thesis.) New Dyes Analogous to Cymyl Orange.

2-Amino-p-cymene-5-sulfonic acid was diazotized and coupled with p-nitraniline. Orange colored dye, needles from alcohol, m.276°-7,° with decomposition. It was also coupled with sulfanilic acid. Zinc orange colored dye, prismatic needles, m.273°-4°, with decomposition.

FRANK K. CAMERON has in press the following articles:

W. H. BASKERVILL and F. K. CAMERON. Ferric Oxide and Sulphuric Acid at 25° C. *Journal of Physical Chemistry.*

Ferric oxide is soluble in aqueous sulphuric acid in amounts directly proportional to the concentration of sulphuric acid until a concentration of 26.4 percent SO_3 is reached and the solution contains 20.5 percent Fe_2O_3. The stable solids in contact with these liquid solutions form one series of solid solutions as shown by the tie lines between liquid concentrations and residues on a chart of the results, the specific gravity and viscosity of the solutions, and X-ray spectograms of the solution. One limiting member of the series of solid solutions is a hydrated ferric oxide, the other a basic sulphate approximating

$Fe_2O_3 \cdot 2.5SO_3 \cdot 7H_2O$. The solubility of ferric oxide falls off markedly in solutions containing more than 26.4 percent SO_3. Four solubility curves were found, in equilibrium respectively with $Fe_2O_3 \cdot 2.5\ SO_3 \cdot 7\ H_2O$, $Fe_2O_3 \cdot 3\ SO_3 \cdot 9\ H_2O$, $Fe_2O_3 \cdot 3\ SO_3 \cdot 8\ H_2O$, and $Fe_2O_3 \cdot 4\ SO_3 \cdot 9\ H_2O$. The system in which $Fe_2O_3 \cdot 3\ SO_3 \cdot 8\ H_2O$ is the solid is entirely metastable. There are no congruent points in the system.

A. T. CLIFFORD and F. K. CAMERON. Dark Field Study of Fibers. *Industrial and Engineering Chemistry.*

The observations of Saunders and Cameron were confirmed by long time X-ray spectograms: that the natural origin of cellulose does not affect the dimension of the unit cell. Attempts were made to find possibly existing differences in cellulose of different origins, by dark field microscopy, it being claimed by certain American observers that the Spierer lens discloses the micelles which these observers measured. Exactly the same micrographs of exactly the same dimensions were obtained of a variety of substances including cellulose fibers. It was shown that the striae observed were purely a function of the microscope assembly and not of the substance under examination. The Spierer lens does not contribute to our knowledge of the micelle.

PROFESSOR CAMERON has published:

E. O. HUFFMAN and F. K. CAMERON. Recovery of the Values in Alunite by Fusion with Certain Alkalis. *Industrial and Engineering Chemistry,* XXVI: 1108-1110. 1934.

The melt of alunite in sodium or potassium hydroxide is soluble in water. The alumina is precipitated by carbon dioxide. The alkali can be recovered from the mother liquid by treating it with the calculated barium carbonate and carbon dioxide under pressure to precipitate all sulphates, and evaporating the resulting solution containing the carbonates of sodium and potassium. These can be separated quantitatively as the bicarbonates, the potassium salt being much the more soluble. A better plan especially applicable to the Utah alunite is to fuse it with a mixture of Glauber's salt, occurring in illimitable quantities about the Great Salt Lake, and powdered coal. This is equivalent to fusing with sodium sulphide which behaves towards alunite as does sodium hydroxide. All the sulphates are reduced in the fusion and after the precipitation of the alumina, the mother liquid contains only the carbonates of sodium and potassium.

He has directed the following research:

WILLIAM HURT BASKERVILL. (Master's thesis.) Physico-chemical Characteristics of Iron Precipitates from Aqueous Sulfuric Acid Solutions.

The solubility of basic ferric sulphates in water at 25° C. has been studied. It was found that:

1. All such systems came to a state of metastable equilibrium which did not change appreciably over a four month period.

2. The final state that is reached depends on the composition and structure of the solids from which the solutions are prepared.

3. At concentrations of around twenty-three per cent there is a tendency for sulfur trioxide to become colloidally dispersed, as measured by the viscosity of the solution, which tendency increases very rapidly with further increases in sulphate content.

4. The solid phases are probably a series of solid solutions of normal ferric sulphate with ferric oxide or its hydroxide.

ERNEST OTTO HUFFMAN. (Master's thesis.) Recovery of Values from Alunite.

Calcinations of mixtures of alunite and potassium carbonate; alunite, lime and potassium carbonate; and alunite and potassium hydroxide were investigated. The last mixture gave the best fusion and permitted extraction of the highest percentage of alumina.

Three methods of recovering the potash values were investigated. First, the leach liquor, after removal of alumina, was treated with lime, potassium hydroxide being formed. This process gave only a 57 percent recovery of potash. Second, the liquor was treated with calcium carbonate and carbon dioxide under pressure. No favorable results were obtained by the process. Third, the liquor was treated with barium carbonate and carbon dioxide under pressure. By this process 97 percent of the potassium sulphate was converted to potassium bicarbonate.

From the results obtained, the lime process evidently has no commercial possibilities. However, the results indicate that the barium bicarbonate process could be operated successfully on a commercial scale.

ALFRED TURNER CLIFFORD. (Doctoral dissertation.) A Study of Cellulose from Various Sources by Means of X-rays and Darkfield Microscopy.

It has been the tendency for cellulose technologists to assume that cellulose from certain sources, for example, cotton stalks and cusps, is not suitable as a raw material for industrial cellulose. This assumption is usually based on the belief that cellulose from these sources is different from the commercial cellulose in its fundamental structure (either the ultimate or the micellar structure). This investigation was undertaken in order to determine, if possible, whether there are differences in the structure of cellulose from the various parts of the cotton plant and commercial cellulose that would render the former unsuitable for industrial purposes.

X-ray diffraction patterns of cellulose from the three parts of the cotton plant and from other sources were compared. An effort was made to apply the Spierer ultramicroscope to a study of the micellar structure of cellulose. X-ray investigations show cellulose from cotton lint, stalks, and cusps and from other sources to be identical, so far as its unit cell is concerned.

The Spierer ultramicroscope is not applicable to the study of the micellar structure of cellulose. Previous investigators have been mistaken in interpret-

ing the lines to be seen with this instrument as micelles. The lines are due to diffraction phenomena.

The existence of larger units in cellulose than those recognized by X-ray methods cannot be shown by present methods of ultramicroscopy.

ERNEST WILLIAM CONSTABLE. (Doctoral dissertation.) The Diverse Equilibrium Behavior of Ferric Sulfate.

An improved constant temperature bath has been described and constructed, which operates at all seasons of the year at 25° C. within 0.1° variation. An improved press for ultra filtration has been described, constructed and tested for mechanical defects, errors due to selective adsorption, etc. Analytical procedures have been tested. Far longer times of contact between solid and liquid phases have been utilized. With these conditions of equipment, the isotherms for the system Fe_2O_3-SO_3-H_2O at 25° C. have been determined with a greater precision and certainty than by previous investigators whose results have been very discordant.

J. T. DOBBINS has directed the following research:

LAURA CORBETT THOMAS. (Progress on doctoral dissertation.) A Volumetric Method for the Determination of Sulphates.

The sulphate ion is quantitatively precipitated by the barium ion. In the presence of alcohol the barium ion is completely precipitated by the iodate ion. Consequently, theoretically, the sulphate ion may be determined by using an excess of a standard solution of barium chloride and determining the excess with a standard iodate solution. The method does not give consistent results. The deviation may occur on either side of the theoretical value depending on conditions. This behavior is, most likely, due to the absorptive properties of barium sulphate.

J. P. SAUNDERS. A Volumetric Method for Cobalt and Nickel.

Both cobalt and nickel are quantitatively precipitated by a mixture of pyridine and ammonium thiocyanate. The solution to be analyzed is placed in 250cc volumetric flasks, an excess of pyridine and standard ammonium thiocyanate solution is added, and then the solution is made up to the mark and thoroughly mixed. An aliquot of 50cc is removed and titrated with a standard silver nitrate solution. From the excess thiocyanate found the cobalt and nickel may be calculated.

Both elements may be determined in the same solution by analyzing the solution for nickel by the dimethylglyoxime method and calculating cobalt by difference.

JAMES KINNEY COLEHOUR. (Master's thesis.) The Determination of Potassium by Means of Perrhenic Acid.

Potassium may be quantitatively recovered from pure potassium chloride but not from potassium chloride—sodium chloride mixtures. The determination of potassium by means of perrhenic acid is not satisfactory because of its inaccuracy, impracticability, and the high cost of rhenium.

HENRY LEITNER EDWARDS. (Master's thesis.) Pyridine as a Precipitant for Certain Metallic Ions in Qualitative Analysis.

Pyridine, in the presence of the thiocyanate ion, precipitates Fe, Al, Bi, Sb, Sn and Cr as hydroxides, and Cu, Cd, Pb, Co, Zn, Ni and Mn as complex pyridine-thiocyanates. Hg, As, the alkaline earths, and the alkalies remain in the solution, from which As and Hg are precipitated by $Na_2S_2O_3$. The Py-CNS precipitate is treated with NH_4OH, which dissolves Cu, Cd, Co, Zn and Ni, which are identified in the filtrate. The insoluble residue, containing Mn, Fe, Bi, Cr, Pb, Al, Sb and Sn, is oxidized by KOH and Br_2, Mn, Fe and Bi remaining as a residue, while Cr, Pb, Al, Sb and Sn pass into solution. The residue is treated with HNO_3 to dissolve the Fe and Bi, which, with the insoluble MnO_2, are subsequently identified. Cr and Pb are precipitated from the filtrate by HNO_3, Al by $KC_2H_3O_2$ in boiling solution, and Sb and Sn are identified in the presence of each other after the removal of the Al.

GEORGE MOTLEY OLIVER. (Master's thesis.) Effect of Phosphates upon The Volumetric Method of Determining Sodium.

The effects of various amounts of phosphates upon the volumetric method of determining sodium were determined. It was found that sodium cannot be determined accurately by the volumetric method in the presence of phosphates. A method was obtained for separating the phosphate ion from sodium, so that the latter can be determined with satisfaction.

H. D. CROCKFORD has published during the year:

(With H. C. THOMAS.) The Debye-Hückel Ion Size Parameter in Terms of Individual Ionic Radii. The Activity Coefficient of Lead Chloride in Solutions of Cadmium Nitrate. *Journal of the American Chemical Society,* LV: 568. 1933.

(With N. L. SIMMONS, JR.) Binary Systems of m-Nitrotoluene and p-Nitrotoluene with Napthalene, p-Toluidine, and o-Nitrophenol. *Journal of Physical Chemistry,* 37: 259. 1933; *Journal of the Elisha Mitchell Scientific Society,* XLVIII: 2: 273. 1933.

(With N. L. SIMMONS, JR.) The Activity Coefficients of Sulphuric Acid in Aqueous Solutions of Ammonium Sulphate at 25°. *Journal of the American Chemical Society,* LVI: 1437. 1934.

(With T. B. DOUGLAS.) The Ionization Constants of Certain Sulphur Derivatives of Phenylacetic Acid at 0° and 25°. *Journal of the American Chemical Society,* LVI: 1472. 1934.

(With J. C. LOFTIN.) The Electrolysis of Aqueous Solutions of Hydrogen Fluoride and Certain Alkaline Fluorides. *Transactions* of the Electrochemical Society, Preprint 66-8, 1934.

PROFESSOR CROCKFORD has directed the following research:

DANIEL BRAWLEY. (Doctoral dissertation.) The System: PbO_2-$PbSO_4$-H_2SO_4-H_2O. (In coöperation with the U. S. Naval Research Laboratory, Washington, D. C.)

This thesis presents a study of the quaternary system: PbO_2-$PbSO_4$-H_2SO_4-H_2O at 0, 25, 35 and 50 degrees Centigrade. The equilibrium has been dealt with primarily from the point of view of the two ternary systems: PbO_2-H_2SO_4 H_2O, and $PbSO_4$-H_2SO_4-H_2O. These two particular systems were chosen, out of the four three-component equilibria necessary to completely define the boundary conditions of the quaternary system, because of their reference to the operating conditions in lead-sulfuric acid storage cells.

The system: PbO_2-H_2SO_4-H_2O was found to involve a reaction in which the lead peroxide was converted into a lead sulfate with the evolution of a gas. The rate of this reaction decreases with decreases both in temperature and in acid concentration. In dilute acids the action is extremely slow, being practically inappreciable in all solutions containing less than twenty-five percent sulfuric aid.

In reference to the system: $PbSO_4$-H_2SO_4-H_2O, tables and diagrams are presented showing the solubility of lead sulfate in water and in solutions containing up to ninety-eight percent sulfuric acid.

The solubility of lead sulfate in water is approximately a linear function of temperature from 0 to about 30 degrees. Above this point the curve shows a tendency to become parallel to the abscissa.

The solubility of the salt in water is sharply depressed by the addition of very small amounts of sulfuric acid to the solution. The solubility drops to a very low value (about 0.0002%) with the first minute trace of acid, and remains then practically constant until the acid concentration is built up to between seventy and eighty percent. Above this point there is a rapid increase in the solubility of the salt with further increases in concentration.

Both in water and in acid solutions the solubility of the salt shows increases with increasing temperature.

The composition of the solid phase in stable equilibrium with all of the acid solutions studied was found to be normal lead sulfate. No acid sulfates exist in the system at the temperatures studied. There were no indications of metastable conditions.

It is believed that final equilibrium is attained in the lead peroxide-sulfuric acid system only when all of the peroxide or the acid has been decomposed. In the lead sulfate-sulfuric acid equilibrium the final conditions of equilibrium were reached in about four days time when the samples were subjected to continuous agitation. The system generally approaches equilibrium with greater speed when it is brought down from a higher temperature.

FRANK WYMAN GRANT. (Master's thesis.) Solubility Relationships in the System: K_2SO_4-$CoSO_4$-H_2O at Low Temperatures.

The ternary eutectic points of the system, two in number, have been located. Phase relationships below zero degrees have been determined and are shown

in the form of a graph. The ternary compound, $K_2SO_4 \cdot CoSO_4 \cdot 6\,H_2O$, exists over a wide range. In connection with this work, an attempt was made to develop a volumetric method for determining sulfates which depends upon the changes in the hydrogen ion activity in acid solutions of sulfates caused by the addition of barium salts. Such a method was developed. The results obtained with it are satisfactory qualitatively, but unsatisfactory quantitatively. The method shows promise and deserves further study.

H. O. FARR. (Progress on doctoral dissertation.) Activity Measurements in Solutions of Lead Chloride and Barium Nitrate.

The activity of lead chloride in solutions of barium nitrate is being measured potentiometrically. From the results it is hoped that calculations can be made that will add to the knowledge of the Debye-Hückel Theory.

T. B. DOUGLAS. (Progress on doctoral dissertation.) The Free Energy of Ionization of Certain Derivatives of Thioacetic Acid.

The ionization constants of phenylthioglycollic acid, phenylsulfoacetic acid, and phenylsulfonyl acetic acid have been determined conductimetrically at 0° and 25.° From these have been calculated the free energies and heats of ionization.

J. C. LOFTIN. (Progress on doctoral dissertation.) Conductance Measurements in Certain Aqueous Solutions at Various Frequencies.

E. C. POWELL. (Progress on master's thesis.) Solubility Relationships in the Systems: $CaCl_2$-$CaBr_2$-H_2O, $AlCl_3$-$CaCl_2$-H_3O.

S. A. WIDEMAN. (Progress on master's thesis.) Determination of the Ionization Constant of Cymyl Orange.

PROFESSOR CROCKFORD continued his research work with the U. S. Naval Research Laboratory, Washington, D. C., during the summers 1933 and 1934. This work involved a continuation of the studies on the lead-sulphuric acid storage cell. The results are given in certain reports to the Bureau of Engineering, U. S. Navy Department.

RALPH W. BOST has published during the year:

(With J. O. TURNER and M. W. CONN.) The Identification of Mercaptans with 2, 4-Dinitrobenzene, II. *Journal of the American Chemical Society,* LV: 4956. 1933.

PROFESSOR BOST has directed the following research:

J. O. TURNER. (Doctoral dissertation.) The Identification and Uses of Mercaptans and Disulfides.

Thirty-nine mercaptans have been studied in this work. When an alcoholic solution of the sodium mercaptide of these mercaptans is allowed to react with an equivalent of 2,4-dinitro chloro benzene dissolved in alcohol, the corresponding 2,4-dinitro phenyl sulfide is precipitated. These sulfides are golden

yellow needles with sharp melting points. The sulfides were converted into their respective sulfones by solvation with glacial acetic acid and oxidation with potassium permanganate. The sulfones are colorless crystals with definite melting points. Photographs of the crystals of certain 2,4-dinitro phenyl sulfides and the corresponding sulfones have been made and studied.

2,4-Dinitro phenyl ethyl sulfide was reduced to para-amino ortho-nitro phenyl ethyl sulfide. From this amino compound the hydrochloride and benzoate derivatives were prepared as well as the diazo chloride. The latter was coupled with various phenols to give azo dyes. These dyestuffs were applied to fibres and the dyed fibers subjected to certain physical and chemical tests to determine their usefulness in commerce.

2,4-Dinitro phenyl ethyl ether was carried through the same reactions as its sulfur analogue and a comparison of its behavior made.

When 2,4-dinitro phenyl thio ether was reduced with ammonium sulfide, the 4-nitro group was reduced, whereas when the oxygen analogue was reduced under similar conditions, the 2-nitro group was reduced. Thus a distinctive case of steric effect has been shown.

Certain new disulfides have been prepared by oxidizing the mercaptans with iodine in methyl alcohol solution. A method for characterizing normal disulfides has been developed by reducing the disulfide with zinc dust and acetic acid and the resulting mercaptan then identified by means of 2,4-dinitro chloro benzene. Many new dyes may be made from mercaptans at a relatively low cost. These dyes are very fast to all ordinary tests.

CATHERINE AYCOCK. (Master's thesis.) The Chemical Composition of Melia Azedarach.

A qualitative study of the constituents of Melia Azedarach was made with particular reference to the nitrogenous matter. The berry was shown to contain 1.45% nitrogen. The presence of a poisonous principle was demonstrated.

ROBERT E. GEE, JR. (Master's thesis.) The Action of 2, 4-Dinitrochlorobenzene on Sodium Alcoholates.

The study discloses results obtained from the reaction of the sodium alcoholates with the organic halide, 2-4-dinitrochlorobenzene. The feasibility of this chemical reaction to promote differentiation of alcohols was tested with representative sodium alcoholates. The reaction was carried out in two steps: first, the sodium alcoholates were prepared by the action of metallic sodium on the respective alcohols, and the halide was dissolved in absolute ethyl alcohol; secondly, the two solutions were refluxed together for thirty minutes to insure complete reaction. The oxy-ethers were all crystalline substances melting within seven degrees of each other.

The studies showed that 2-4-dinitrochlorobenzene is not a good reagent for alcohols.

DAN FORE, JR. (Master's thesis.) The Chemical Composition of the Oleaginous Constituent of Melia Azedarach.

From the fruit of Melia Azedarach 5.6-5.8% of a bright yellow oil of peculiar odor was extracted and analyzed. The physical constants of the oil are: Ref. Index, 1.4766; Sp. Gr. 25°/30°, 0.9182; Acid Value, 3.62; Iod. No., 135.4; Sap. Value, 191.2; Non-sap. material, 1.7%. The oil is composed chiefly of the glycerides of saturated and unsaturated fatty acids. The saturated fraction, which amounts to 11.45% of the whole oil, is made up of 55.95% palmitic and 44.05% stearic acid. These acids were determined by fractional distillation of their methyl esters. The unsaturated fraction was analyzed by Kaufman's thiocyanometric method. It amounts to 88.43% of the oil and contains 41.82% oleic acid and 58.18% linoleic.

The fruit of Melia Azedarach contains, other than oil, glucose, proteins, and a poisonous principle in the form of an unknown alkaloid which occurs in traces.

R. H. BELCHER. (Progress on doctoral dissertation.) The Separation and Identification of Sulfides, Sulfoxides and Sulfones.

Approximately thirty alkyl, alkyl-aryl and aryl sulfides have been studied with mercuric chloride under various conditions with different solvents. A method for their separation and identification has been proposed. Studies are now under way showing the effect of refining agents on the above sulfur compounds when dissolved in naphtha.

B. O. COSBY. (Progress on doctoral dissertation.) The Synthesis, Structure and Reactions of Thioketones.

Phenyl biphenyl, phenyl, alpha-naphthyl, phenyl 2-methyl phenyl, phenyl 3-methyl phenyl, phenyl 4-methyl phenyl, phenyl 2-chlorophenyl, phenyl 3-chloro phenyl, phenyl 4-chlorophenyl and phenyl 4-nitro phenyl thioketones have been prepared. Absorption spectra studies have been made on the above compounds as well as their oxygen analogs. Interesting cases of polymorphism are shown by some of the thioketones.

J. H. WOOD. (Progress on doctoral dissertation.) The Mechanism of Thio-Aldehyde Formation.

This study was undertaken to determine the factors involved in the formation of thio-aldehydes. The work has been confined chiefly to the action of hydrogen sulfide on benzaldehyde in the presence of various catalysts at different temperatures. Several products, including the thio-aldehyde, have been isolated from the reaction mixture. These products are now under investigation.

FRANK NICHOLSON. (Progress on master's thesis.) The Identification of Phenols with 2, 4-Dinitrochlorobenzene.

2,4-Dinitrochlorobenzene reacts with sodium phenolate in alcoholic media forming phenyl 2,4-dinitrophenyl ether. The twenty phenols thus far studied react similarly. All have definite crystalline structure and sharp melting points. The reagent is ideal for phenols.

WALKER F. HUNTER, JR. The Destructive Distillation of Peanut Hulls.

The ether soluable material, moisture, nitrogen and ash content of peanut hulls were determined. The hulls were subjected to destructuve distillation using an electrically heated iron retort. The complex distillate has been shown to contain fatty acids, ketones, esters, phenols and other interesting substances.

WILLIAM ROGERS JOHNSTON. Tobacco Studies. The Chemical Composition of Tobacco.

Studies were begun showing the variation of certain chemical compounds in the different grades of tobacco.

A. MCLAREN WHITE has published:

Studies in Agitation, III. (With S. D. SUMERFORD.) The Simple Agitator as a Classifier. *Journal of Industrial and Engineering Chemistry,* XXVI: 82. 1934.

Studies in Agitation, IV. (With EDWARD BRENNER, G. A. PHILLIPS, and M. S. MORRISON.) Power Measurements. Studies in Agitation, V. (With EDWARD BRENNER.) The Correlation of Power Data. Reprints, *Transactions* of the American Institute of Chemical Engineering. New York Meeting, May, 1934. (To appear in Volume XXX.)

PROFESSOR WHITE is continuing the study of agitation and mixing in an attempt to determine the mathematical relations governing stirrer performance.

With A. E. NEW he has continued the study of pressure drop through packed towers with special reference to the effect of circulating liquids countercurrent to the gas stream.

PROFESSOR WHITE has directed the following research:

S. D. SUMERFORD. (Doctoral dissertation.) The Suspension of Sand in Water.

As the most straightforward method available, it was decided that sand and water would be the two components used in a study of the effect of different variables on both the intensity and the efficiency of agitation. As it was deemed necessary to study a system which was dependent only on the flow of the liquid past the surfaces of the solid to be suspended, any other system composed of a denser solid to be suspended in a less dense liquid would serve the purpose just as well. The amount of suspended solid per unit volume is taken as the measure of intensity of agitation, and the amount of suspended solid per unit volume per unit power demand is taken as the measure of efficiency.

The following conclusions have been reached: 1. For a constant liquid level, the effect of changing the paddle height changes the quantity of suspended

solid at any one sampling point, but the same relative change is in evidence for all the other sampling points. 2. Uniformity of concentration of the suspended solid is never realized when a cylindrical tank is used with a simple paddle agitator, but the higher the paddle from the bottom of the tank, the more nearly is the concentration uniform throughout the tank. However, the greatest concentration is realized when the paddle is near the bottom of the tank. 3. As the agitator speed is increased, the concentration of suspended matter increases up to a critical r. p. m. (here called the saturation r. p. m.). Further increase in agitator speed has little or no effect on the concentration of suspended sand. 4. Due to different liquid-velocity areas, a cylindrical tank equipped with a paddle agitator may be used for hydraulic separation of fine from coarser particles of solid. 5. Samples taken from any one point have been found to be representative of the condition of the tank as a whole. 6. The most effective paddle size to use is one to which the ratio of a paddle length to tank diameter is 0.5, and the ratio of paddle length to paddle width is 4.0. 7. The conditions which give the most effective agitation also give the most efficient agitation.

PROFESSOR WHITE directed the following master's thesis (accepted by the School of Engineering):

EDWARD BRENNER. The Effect of Tank Diameter on the Power Consumption of Simple Paddle Agitators.

Tank diameter has a marked effect on power consumption of simple paddle agitators. All other variables remaining constant, three distinct power regimes appear as diameter is increased. The first of these shows a period of slightly rising power which breaks sharply into the definite minimum of the second regime. This is followed by rising power until the maximum is reached, at which point the third regime of constant power is attained. Maximum stirring occurs at the same (length-diameter) ratio as minimum power; this indicates the existence of reinforced standing waves or the formation at this point of a natural vortex. By far the most efficient paddle agitator is one in which the paddle length is approximately one-half the diameter of the containing vessel.

DEPARTMENT OF CLASSICS

G. A. HARRER has in preparation:

The Copying of Military Diplomas.

A Roll of Leading Men of the Roman Republic.

J. PENROSE HARLAND has published:

Scripta Helladica and the Dates of Homer and the Hellenic Alphabet. *American Journal of Archaeology,* 83-92. 1934.

He has also published the abstract of an article, Contributions of the Helladic Bronze Age. *American Journal of Archaeology,* 189. 1934.

PROFESSOR HARLAND has, during the past two summers, been preparing for publication, The Excavations of Tsoungiza, the Prehistoric Site at Nemea, to be completed within the coming year.

He has also continued to assemble material for a work on The Helladic Civilization.

The following master's theses were completed during the year under the supervision of the Department:

LESSIE B. PHILLIPS. Character Sketches in Sallust. (Under the direction of G. A. HARRER.)

This thesis presents Sallust's use of character sketches, considering the types of persons selected for characterization, and the various elements of the analyses of character. The values of other parts of the histories, especially the speeches, in describing the chief personages are also considered.

EUGENE R. SMITH. Index Verborum Coniurationis Catilinae. (Under the direction of G. A. HARRER.)

In this study there is presented a complete index of words in Sallust's Catiline, for which Ahlberg's Teubner text was taken as standard, while other texts and vocabularies were used as supplementary.

FRANCES STANSELL. The Rôle of Anna in Vergil and Ovid. (Under the direction of GEORGE HOWE.)

The object of this study is to present the rôle and character of Anna as portrayed by Vergil. For purposes of comparison and contrast Ovid's treatment of the same character, a survey of the traditional view of Anna before Vergil, and an exposition of the conventional rôle of confidante in earlier literature are included.

ELIZABETH WHITE. Seneca and Suetonius on the Reigns of Caligula and Claudius. (Under the direction of G. A. HARRER.)

The object of this study is to gather the references to historic facts and persons in the time of Claudius and Caligula, and to consider possible relationships between the accounts given in the works of the two authors, Seneca and Suetonius.

MARY CATHERINE WILLIAMS. Transitional Devices in Suetonius's *De Vita Caesarum*. (Under the direction of G. A. HARRER.)

This peculiar categorical method of arrangement of historical and biographical materials adopted by Suetonius in his Lives, with almost complete neglect of chronological sequence of events, leads to a detailed study of the various means used by the biographer in transition from one category to another. All verbal devices are considered and also transitions effected or influenced by the content of the narrative.

The following studies have been undertaken by candidates for advanced degrees:

B. W. DAVIS. A study of the Political and Personal Relationships Between Cicero and Pompey. (For the master's degree.)

MARY DIGGS. A study of the Literary Background of Aulus Gellius Based on a Consideration of the Writers to Whom he Refers. (For the doctor's degree.)

JEWEL GODWIN. Pliny the Younger's Attitude toward Literary Production. (For the master's degree.)

ANNE M. OWEN. A Comparison of Certain Features in the *Culex* and *Aeneid VI.* (For the master's degree.)

ALBERT I. SUSKIN. A Study of Livy's Methods of Arranging and Presenting his Materials. (For the doctor's degree.)

EVELYN WAY. Seneca's Influence on Writers of History Among the Romans. (For the doctor's degree.)

DEPARTMENT OF ECONOMICS AND COMMERCE

E. E. PEACOCK directed the following research:

G. H. HOLMES. (Progress on master's thesis.) A Cost System for Medium Sized Banks in the United States.

ERICH W. ZIMMERMAN has published:

World Resources and Industries. A Functional Appraisal of the Availability of Agricultural and Industrial Resources. New York and London: Harper and Brothers. 1933.

For a summary account of the content of this book see *Research in Progress,* 1933.

Output of Work and Economic Well-Being. *American Economic Review,* XXIV: 2. 1934.

Some technocrats seem to believe that national wealth tends to be proportionate to national expenditure of energy, in particular, mechanical energy. A recent contributor to this journal expressed this belief. Being incompatible with fundamental tenets of price economics and at variance with observable reality, this belief calls for a critical appraisal. The relationship between energy expenditure and economic well-being is conditioned by the general nature of economic systems such as the use of capital equipment, the man-land ratio, dependence on outsiders, etc. Under market economy the relative scarcity of a product materially affects the economic well-being of its producer. Under certain circumstances a negative correlation between energy expenditure and well-being may be found to exist. Since the energy spent in the production of capital goods generally contributes to well-being only after a considerable time lag, correlation figures on a one-year basis may be meaningless. Creditor countries are apt to benefit from energy expenditures incurred by the debtors.

PROFESSOR ZIMMERMAN is directing the following doctor's dissertations:

FRED ARNOLD. Crop Control, Its Economic and Social Implications with Special Reference to Cotton.

M. O. PHILLIPS. The Rise and Decline of the "Tramp" in World Shipping.

JOHN B. WOOSLEY is continuing his study of the methods employed by the several states in taxing banks.

The following studies are in process under his direction:

LYLES G. MCNAIRY. (Progress on doctoral dissertation.) The Influence of Changing Banking Codes on American Banking.

JOHN S. VAUGHAN. (Progress on master's thesis.) The Temporary Insurance of Bank Deposits.

G. T. SCHWENNING is continuing his preparation of a book on The Dismissal Wage.

He has published during the year:

Continental European Dismissal Wage Plans. *Social Forces,* XII: 2. 1933.

British Law Regulating the Termination of Labor Contracts. *North Carolina Law Review,* XII: 1. 1933.

He has completed the following articles which have been accepted for early publication:

British Dismissal Gratuities.

Dismissal Wage Legislation in Latin-American Countries.

PROFESSOR SCHWENNING is directing the following research:

E. H. ANDERSON. (Progress on doctoral dissertation.) A Synthesis of the Theories of Administrative Control Organization.

MALCOLM D. TAYLOR read the following paper before a meeting of the National Association of Marketing Teachers in Philadelphia, December 27, 1933, Pricing of Branded Groceries.

He has published during the year:

Prices of Branded Grocery Commodities during the Depression. *Harvard Business Review,* XII: 4. 1934.

PROFESSOR TAYLOR is directing the following research:

VIRGINIA F. YANCEY. (Progress on master's thesis.) An Appraisal of Advertising as a Marketing Device.

ROBERT F. GALBREATH. (Progress on master's thesis.) The Place of the Middleman in Present Day Marketing.

M. S. HEATH has published:

Motor Transportation in the South. *Southern Economic Journal,* August, 1934.

A survey of the facts and dynamic factors in southern transportation.

The Prospect of Optimum Regional Production in the Southern Regions. *Social Forces,* October, 1934.

This paper is a preliminary survey of the theoretical tools available for a broad regional economic study of the prospects, from the theoretical point of view, for conducting such a study of the southern states.

PROFESSOR HEATH is also continuing studies in the History of Southern Transportation.

With M. K. HORNE he is making a study of Savings in the South.

With REX WINSLOW he is making a study of the History of American Profit Theories.

H. D. WOLF has the following research in progress:

The Yellow Dog Contract.

The Doctrine of High Wages.

The Labor Policy, Past and Present, of the Federal Government.

Study of Unemployment Conditions and Unemployment Relief in North Carolina. (For the North Carolina Commission on Unemployment Insurance.)

He has under his direction:

H. M. DOUTY. (Doctoral dissertation.) The North Carolina Industrial Worker, 1880-1930.

R. HOOD. (Doctoral dissertation.) Labor Standards and Labor Conditions in the South.

R. HOOD. A Bibliography of Southern Labor.

PROFESSOR WOLF has directed the master's thesis of CHARLOTTE J. CALIFF, Wage Differentials between Whites and Negroes in the South. (For abstract, see p. 79.)

The following doctoral dissertation was accepted by the Department during the year:

STANLEY WALES PRESTON. The Influence of Commodity Characteristics, Organizational Forms, and Institutional Environment on

Price: As Shown in the Cases of Wheat, Rubber and Coal. (Under the direction of C. T. MURCHISON and ERICH W. ZIMMERMAN.)

It is becoming increasingly apparent that an analysis of general price behavior of a commodity or of a group of commodities does not and cannot accurately indicate the character and the degree of influence of the major factors involved in the price determining relationship. Each particular commodity seems to be affected by forces peculiar to itself. While certain groups of commodities can be distinguished which appear in general to be subject to the same influences, further investigation reveals rather fundamental differences. It is the purpose of this study to show the importance of some of these fundamental differences and to indicate how through influencing the productive process they affect price. The aim is not to deny the usefulness or validity of general analysis but rather to indicate the need for supplementing it with specific observations.

Three classes of factors influencing price are treated: the classification is based upon whether the factors derive their influence from the characteristics of the commodity, or the form of organization of the industry developing the commodity, or the peculiar institutional environment. An analysis of the way in which these three classes of factors operate is made for three typical commodities. Wheat is used to represent agricultural annual commodities, rubber to represent agricultural perennials, and coal to represent minerals. By first presenting a section dealing with the type of commodity as a whole, the general characteristics and scopes of each classification of commodities are indicated; and second, the position of the particular commodity in the general classification which it typifies is shown.

The analysis leads to the conclusion that all three classes of factors play a part of considerable importance in determining the price of the examined commodities. More specifically the conclusions may be summarized as follows:

1) The factors entering into the price determining relationship for any given commodity vary to such an extent, both in terms of the number of factors involved and the degree of influence of any one factor, that the resultant behavior pattern is unique for each commodity. Hence the need for specific studies to supplement general analyses is indicated.

2) Integration of industrial consumer units with basic commodity producer units appears to be increasing where the command of capital possessed by the industrial consumer enables economies of production, great assurance of continuity of supply, or possibilities of monopolistic profits. Integration in the coal industry is common. Integration in the rubber industry is increasing. Integration has not occurred and is not likely to occur in the wheat industry unless it is brought about through farmers' cooperatives or similar organizations.

3) Institutional factors exert powerful influences as price determinants.

4) Organization characteristics as factors in the price determining relationship appear themselves to be somewhat conditioned by institutional factors and commodity characteristics.

5) Integration and coordination of governmental policies guiding basic commodity production appears to be more probable than reorganization of control measures upon a world basis.

The following master's theses were prepared during the year under the direction of the Department:

ROBERT WARREN BARNETT. The Industrial Revolution: A Study in Comparisons and Contrasts: England of 1750 to 1800 and China of 1900 to 1934. (Under the direction of ERICH W. ZIMMERMAN.)

This thesis, which concerns the transforming effects of industrialism upon English economy, traces the incipience in the commercial revolution, through the period of specialization in industrial and agricultural enterprise, through the development of the factory and the metal industries, to its state of maturity. The paper, then, takes up a descriptive analysis of the Chinese scene. In attempting to analyze the evolution of industrialism in China the study does so by contrasting and comparing the evolutionary changes with those that preceded in England.

JAMES HENRY MCCORMACK. Appalachian Coals, Incorporated: A Study of Its Organization, Legality, and Functioning. (Under the direction of MILTON S. HEATH.)

The first chapter is devoted to establishing a background against which the more particular features of Appalachian Coals, Incorporated, are to be silhouetted. The deplorable conditions in the industry caused by effects of the war, substitute fuels, and more efficient utilization of coal is discussed. Suggestions for a "way out" are treated.

The next chapter is given over exclusively to Appalachian Coals, Incorporated. The history of its organization, as well as its *modus operandi* under its charter, by-laws and contracts, is told. The suits before the District Court and the Supreme Court are covered. Attempts to create similar agencies and the financial situation of the important member producers are taken up, as well as an analysis of the first annual report of Appalachian Coals, Incorporated.

In the concluding chapter analogous coal sales agency cases are treated. Lastly, there is a discussion of the matter of price fixing among independent producers. The significance for the future of the decision in the Appalachian Case is made the subject of the final paragraphs.

LYLES GLENN MCNAIRY. The Effects of Changes in the National Banking Laws on the Relative Position of the National Banking System. (Under the direction of JOHN B. WOOSLEY.)

This study attempts to trace the changes in the relative position of the national banks in the commercial banking system of the United States from 1900 to 1927, and to appraise the amendments to the national banking code as factors in such changes. The change of status of the national banks is traced from a position of almost complete dominance shortly after the Civil War to the period following the World War when the national banks

possessed less than one-half of the commercial banking resources of the nation and numbered only one-third of the commercial banks in the United States. The conclusion is reached that while the changes in the national banking laws have not made federal charters so attractive as materially to increase the importance of the national banks in the commercial banking structure, they have, nevertheless, checked the exodus of national banks from national into state charters.

JAMES SALEN MORRISON. An Analysis of Municipal Accounting Procedure With Particular Reference to the Town of Chapel Hill. (Under the direction of E. E. PEACOCK.)

This thesis is concerned with the presentation of principles, forms, methods, and statements of accounting applicable to municipalities up to ten thousand population in the State of North Carolina. The subject matter is confined primarily to the state laws affecting municipal accounting and budget procedure. The accounting and budget procedure of the Town of Chapel Hill, Orange County, State of North Carolina, is outlined for the purpose of comparing principles with practice and for presenting with proposed changes a model accounting procedure for smaller municipalities.

HERMAN C. NOLEN. Modern Methods of Designing Retail Stores. (Under the direction of MALCOLM D. TAYLOR.)

This study emphasizes the importance of scientific store planning in modern mercantile establishments and outlines the general principles of store design that are involved. The point of view taken is that the working out of the layout plan is essentially a problem in research as each store presents a different set of factors which must be individually considered. A sound merchandising plan for a store must first be devised and from this is evolved the actual layout of traffic arteries, the distribution of selling and service areas, and the location and arrangement of departments.

The planning of department stores is treated in detail since the principles of design that apply to them apply with almost equal force to all other types of stores. A detailed discussion is given of the mechanical features of lighting and air conditioning. The conclusion is reached that a store has been properly designed when buying has been made easy, convenient, and pleasant for the customer. The nearer this goal is approached, the larger will be both the volume of sales and the profits that will accrue to the store management.

CHARLES JUDAH SHOHAN. Public Financing of Retail Stores, 1928-1930. (Under the direction of JOHN B. WOOSLEY.)

A study of security offerings by retail stores from 1928 through 1930. An attempt is made to distinguish features of corporate practice peculiar to this field of enterprise, and to determine the relation of the financial policies of retail stores to the theory and practice of corporation finance. It is concluded that despite certain distinctive irregularities, retail store financing tends to conform to recent developments in corporation finance as a whole.

DEPARTMENT OF EDUCATION

EDGAR W. KNIGHT has published during the year:

Education in the United States, ix, 626. Boston and New York: Ginn and Company. 1934. (Revised edition.)

Report of the Educational Inquiry Commission (of Iraq). A report (with others) to the government of Iraq. 170. Bagdad: Government Printing Press. 1933.

Education in the South, in *Culture in the South.* Chapel Hill: The University of North Carolina Press. 1933.

Public Schools from the Colonial Period to the Present. *Our Public Schools.* Washington, 1934.

A History of Secondary Education in Pennsylvania. *Educational Outlook,* March, 1934.

He is continuing a study, begun in July of 1933, of recent tendencies and current problems in the curriculum of the American college, with reference especially to conditions in the University of North Carolina.

A. M. JORDAN has completed a text entitled *How to Study,* not yet published.

A. K. KING has been engaged in the following research:

The Political, Economic, and Social Ideas of Five Eighteenth Century Virginia Writers.

The Social Philosophy of Thomas Paine.

The following theses have been completed during the year under the guidance of the Department:

CLARENCE M. ABERNETHY. A Survey of Public Education in Caldwell County. (Under the direction of GEORGE HOWARD.)

The purpose of this study was (1) to set forth the educational conditions of both the high schools and elementary schools of Caldwell County, and (2) on the basis of facts found to offer suggestions for further improvement of the school system. The sources of information are mainly the records of the county superintendent's office.

The survey revealed the following outstanding weaknesses: (1) too many small schools; (2) poor teacher adjustments; (3) heavy teacher load; (4) meager curricula offerings in the high schools; (5) high percentage of failures; (6) unnecessary transportation because of the operation of two administrative units in the county.

It was recommended that Caldwell County be made a single administrative unit, that five consolidation centers be established for high schools instead

of eight, that fourteen consolidation centers be established for elementary schools instead of twenty-one, thereby reducing the total number of schools in the country from twenty-nine to fourteen.

NANCY LEE CARROLL. The Relative Values of Certain Factors in Predicting Success in First Year Latin. (Under the direction of R. W. MORRISON.)

Prognoses of teachers' marks in Latin and New York Latin Achievement scores were made by using seventh grade average marks, seventh grade English marks, and scores on the Orleans-Solomon Latin Prognosis Test, Terman Group Test of Mental Ability, and New Stanford Achievement Test.

Relations were found through zero, partial, and multiple correlations. Regression equations were computed for predicting the scores of individual pupils.

Teachers' marks were more successfully predicted than test scores. The best single predictor was the average of seventh grade marks; the best two-variable combination consisted of seventh grade marks and Stanford scores; the best three-variable combination added Terman I. Q's to the seventh grade marks and Stanford scores.

The correlations obtained indicate that, with the variable used, a fairly satisfactory prediction of Latin achievement can be made.

ADDISON BOYCE COLLINS. Historical Study of the Union County Schools. (Under the direction of E. W. KNIGHT.)

This study traces the development of education in Union County from the beginning of the earliest schools up to the present time. Since the county was not organized until 1842, conditions prior to this date have been briefly described. The early academies played a prominent part in laying the foundations for the development of education before the Civil War. From the days of reconstruction until the revival in the early years of the twentieth century, the schools showed a slow growth. Local private academies established during the latter quarter of the nineteenth century played a leading rôle in creating a wholesome educational sentiment. The period from 1900 to 1920 was one of substantial development. Rapid progress was made during the decade from 1920 to 1930. Present educational conditions in the county appear to compare favorably with those of the other counties in the state.

ANNE WOOLLEN FERREE. The History of Higher Education of Women in Virginia. (Under the direction of E. W. KNIGHT.)

The scope of this study is from the Colonial Period up to the present time. The apprenticeship system was the outstanding system in Virginia in the Colonial Period. There was little effort made to establish any organized system of education until Thomas Jefferson proposed his "Bill for the More General Diffusion of Knowledge" in 1779. This bill did not pass the legislature but it aroused public opinion for a more universal and free system of education.

The period from 1775 to 1860 was characterized by the establishment of Female Academies and Seminaries, many of which were established under the auspices of the church. The academies fall into two groups: the first served only the community in which it was located; the second was of wider scope.

After 1860 the South witnessed a turning point in its educational development. During the struggle of reconstruction the public spirited, thinking people realized the need for a more universal system of education. The changes in economic and social life brought about many changes in education.

The first permanent schools for the advancement of higher education for women in the State were established in 1842. They were Mary Baldwin Seminary at Staunton and Hollins College near Roanoke. In 1884 a legislative act provided for a teacher's college to be established at Farmville. The city of Lynchburg raised a large sum of money in 1891 and gave it to the Randolph-Macon Board of Trustees to establish a college there that would afford higher educational advantages to girls equal to those of men's colleges. In 1901 Sweet Briar Institute (later college) was established. Westhampton, a college of liberal arts and sciences, in the University of Richmond was opened in 1914; William and Mary College admitted girls in 1918; and the University of Virginia became coeducational in 1920. These colleges are the outstanding contributors to higher education for women in the State.

HELEN FLEMING. An Experimental Study of Two Methods of Teaching Reading to Beginners. (Under direction of W. J. McKEE.)

This study was undertaken to determine the relative achievements, as measured by (1) Gates Reading Tests, (2) Sangren Informational Test and (3) specific ratings of character, of two types of teaching procedures, an Activity and a Formal method, in teaching reading to beginners.

The pupils in the Activity and Formal groups were equated as to intelligence quotients, chronological ages, mental ages, experience backgrounds, and parental occupations. In each group the pupils were divided on the basis of their intelligence quotients into three sections of high, average, and low intelligence, with one pupil in the Activity group paired with one similarly classified in the Formal group. Other factors considered were similarities of school environment and qualifications of the teachers. At the end of eight weeks and again at the end of the school year, gains and losses in reading achievement and in experience background were computed. At the end of eighteen weeks and at the end of the year the social adjustment gains, as measured by teachers' ratings on chosen character traits, were computed. In the initial period the Activity group, as a whole, seemed to be superior to the Formal one in its achievement in word recognition, phrase and sentence reading, experience background, and character traits. For pupils of high and average intelligence, the Activity method seemed to have a considerable advantage, while for those of low intelligence, the Formal appeared to be slightly superior in all the above achievements except in experience background. For the entire year the Activity group, as a whole, appeared to

have a very slight advantage; however, for the three intelligence groups, considered separately, the situation was the same as it was at the end of the initial period of eight weeks.

ATKIN BURNETT JOHNSON. A Critical Study of the Marking System in the High Schools of Harnett County. (Under direction of GEORGE HOWARD.)

The fall semester marks of 1932-33 for each pupil in the secondary schools of Harnett County were studied to determine whether or not the teachers in those schools were consistent in their marking.

The study shows that in the county selected, the teachers of the secondary schools in the fall semester of 1932-33 were inconsistent in their marks and that the same subjects throughout the county were marked inconsistently. The study also presents suggestions as to securing more consistent marking in this county, and a procedure is given whereby principals may study and improve the marking systems in use in their schools.

W. H. E. JOHNSON. Latin and Greek in Southern College Curricula from 1800 to 1865. (Under the direction of E. W. KNIGHT.)

The introduction to this study describes the general state of higher learning in the South. The purpose is to reveal the extent of attention to the classical languages in the southern colleges of the United States prior to the Civil War. The plan of the thesis consists of a series of studies of the eight colleges predominant in the South during the period. Each is studied intensively, and frequent comparisons are presented. It is the conclusion of the author that a superficial study of the classics was prevalent throughout the period, and that the shallow knowledge derived from such study was generally accepted by the public as profound learning. It must be noted, however, that the really fine teachers of the ancient languages realized that the instruction was without firm foundation in spite of the attention devoted to it. The conclusion also points out salient examples of the decline of classical study in the late part of the period.

HILDA FLOWE MCCURDY. A Study of the Extent and Nature of Teachers' Reading During a Summer School of the University of North Carolina Apart From the Required Reading of Classroom Assignments. (Under the direction of W. J. MCKEE.)

This study is an attempt to determine the relation of the unassigned professional reading of teachers enrolled in a summer school session of the University of North Carolina to (a) courses taken by the teachers, (b) present or desired occupational positions of the teachers, and (c) their classroom problems.

Data for the study are based upon returns from 107 questionnaires distributed to teachers enrolled in the School of Education of the University of North Carolina (Summer School of 1932). These data indicate that teachers choose and read unassigned professional books more closely related to

their summer school courses and to their present or desired positions than to their classroom problems.

Occupational status, sex, teaching experience, and environment appear to be factors influencing the selection of unassigned professional reading of teachers enrolled in summer school.

MARTHA SERENE MENDENHALL. Relative Effect of Promotion and Repetition Upon Progress in Achievement Tests. (Under direction of R. W. MORRISON.)

The purpose of this study was to find the relative advantage to the child of repetition of a grade and of special promotion, when he has failed to reach the standards in subject matter that have been set up for promotion.

Two groups of one hundred children each were selected in April, 1932, from the fourth, fifth, and sixth grades in Columbus County, North Carolina. These groups were of approximately equal chronological age and achievement level as measured by Stanford Achievement Tests and teachers' judgment. One group was given special promotion; the other was caused to repeat the grade. The change in test scores from April, 1932, to April, 1933, was measured for each child and the distribution and average of gain for the two groups compared. It was found that the specially-promoted group made greater average progress in all tests and in all grades, that this group was more regular in attendance, and that the school mortality was less among the promoted children.

WILLARD VONIVER NIX. A Diagnostic and Remedial Study of the Causes of Irregular Attendance in Duplin County. (Under the direction of GEORGE HOWARD.)

This is a study of non-attendance of school children based upon the record of 3324 pupils, as reported by the classroom teachers, in the white consolidated high school units of Duplin County, North Carolina. The record studies covered a period of six months during the session of 1932-1933. The causes of poor attendance in their order of importance were found to be: sickness, home and farm work, indifference, weather, poverty, visiting, truancy, and bus trouble. Accelerated and normal pupils were found to attend better than those who were retarded in the grades, children of home-owning farmers better than those of tenant farmers, and non-transported pupils better than those transported.

LINDSEY JACKSON PERRY. A School Building Program for the Reidsville Public Schools. (Under the direction of GEORGE HOWARD.)

An attempt has been made to analyze the Reidsville, North Carolina, School District from the standpoint of school building needs, and to set up an adequate building program over a period of years.

EDNA QUEENER PROFFITT. An Investigation of the Science Knowledge Possessed by Children in Grades Four to Seven Inclusive, in a

Typical Rural County in Eastern North Carolina. (Under the direction of C. E. PRESTON.)

It is the purpose of this study to secure experimental evidence of the science knowledge of the children in grades four to seven inclusive, in a typical rural county in Eastern North Carolina and to determine what phase of science, namely: animal life, physics, chemistry, astronomy, and geography, they are most and least familiar with.

To this end objective tests were prepared and given to 1170 pupils representing eight consolidated schools in Sampson County, North Carolina. It was found:

(1) There were certain topics on which information was definitely lacking, (2) the children had scanty information on science knowledge acquired from classroom instruction, (3) their science information in general was very meager, (4) observation questions rated highest and memory questions lowest in all four grades, (5) they knew more about what things were than they did about the principles underlying the use of things, (6) they knew most about animal life and least about astronomy, (7) the results of this study further substantiate certain large findings made by Dr. Hillman in his study of science in the elementary schools.

GLENN THEODORE PROFFITT. The Academic Training and Experience of the Teachers in the Accredited Secondary Schools of North Carolina. (Under the direction of GEORGE HOWARD.)

The purpose of the study was to compare the teaching force employed in the accredited secondary schools of North Carolina in 1932-33 with the teaching force employed in the same schools in 1922-23. Questionnaires were sent to the teachers and principals of 92 accredited secondary schools. The information obtained in this way was supplemented by data obtained from records in the office of Dr. J. H. Highsmith, State High School Inspector. Among other findings, the following were outstanding: The teachers in the accredited secondary schools of North Carolina in 1932-33 were more mature in age, were better trained, had more experience in teaching, and received smaller annual salaries than the teachers in these schools in 1922-23.

NELLIE BASS RICHARDSON. Analysis of Pupil-Error in French Grammar. (Under the direction of R. W. MORRISON.)

The frequency with which high school pupils of French make certain errors in grammatical constructions was the basis for the study. Both constructions peculiar to first year French and those selected from two years of French study were analyzed separately. The records studied included those of 672 pupils in New York high schools, 270 pupils from selected high schools in Georgia and South Carolina, and 454 entering freshmen at the University of North Carolina. A study of errors in French grammar reveals a real need for improvement of the pupil's ability to deal with general and specific grammatical constructions. Little improvement, if any, was found in grammatical proficiency at three

levels of instruction. The need for applying more careful diagnostic and remedial measures in teaching is clearly indicated. The conclusions are limited by the inadequate scope of the tests used.

MARTHA TAYLOR. An Integrated Course of Study in Elementary Science for the Third Grade. (Under the direction of W. J. McKEE.)

The following procedure was employed:

First, an analysis was made to determine the composite aims and objectives: (a) educational leaders in the fields of science were asked to suggest outstanding courses of study; (b) there was an evaluation of the recommended courses to secure the best ones; (c) all of the aims and objectives from the chosen courses were evaluated on the basis of approved criteria; (d) a classification of the large aims was made to secure a small number of composite ones; (e) a classification, integration, and revision of the objectives were made to make these consistent with the composite aims.

Second, an analysis was made to secure the units of work which would be in accord with the best current practice, and with the composite aims and objectives: (a) the science topics from the selected courses of study, the best textbooks on Elementary Science, and outstanding professional books were listed; (b) there was a classification of these topics under chosen unit headings that were consistent, or were made so, with the composite aims; (c) there was a selection of the topics that received a majority mention from the three sources above; (d) a supplementing of the topics in order to make these consistent with the aims and objectives; (e) a final checking to determine consistency and integration of all phases of the suggested science course (principles, composite aims, objectives, units of work, and topics).

A sample unit was constructed to illustrate a possible procedure through which the activities and topics of the unit may be used to attain the chosen aims and objectives.

CAROLINA BRUNETTA WILSON. Some Effects of Grade Repetition on Pupil Achievement. (Under the direction of M. R. TRABUE.)

This study of the effects of grade repetition on pupil achievement is based on the scores made by 300 pupils in grades four, five, six, and seven as shown by records of the New Stanford Achievement Test, Advanced Examination, during the period 1930-1934. The individual pupil records were copied from original school files in the office of the Board of Education of Nash County, North Carolina. The records studied cover a period of five years and include only those pupils who were in the seventh grade during the school year 1933-34. Records of repeaters and non-repeaters were studied to find the relative gains of both groups. Gains for the year of repetition, for the year before repetition, for the year after repetition, and the total progress for the five-year period were found and compared with the gains made by non-repeaters from grade to grade and with their total gains. Repeaters made greater gain during the year of repetition than they did any other year considered, and noticeably more than in the year before repetition. The sixth grade repeaters showed greater gain than any other group, while grades four, five, and seven gained the same during the year of repetition.

SCHOOL OF ENGINEERING

W. J. MILLER is directing the following research:

JAMES R. MARVIN. (Progress on master's thesis.) Calculation of the Distribution of Third Harmonics in Transformer Networks.

T. F. HICKERSON has published during the year:

Structural Frameworks: A New Method of Analysis, With Tables. Chapel Hill: The University of North Carolina Press. 1934.

This book contains a new method for analyzing the bending stresses in buildings, bridges, bents, culverts, viaducts, and other framed structures. There are 147 pages, presenting (1) a full treatment of the theory involved, (2) numerous illustrative drawings and examples, and (3) 69 pages of original tables applicable to various types of continuous beams and frames, in which restraining influences due to the supporting columns are taken into account for the first time.

Among the novel technical features of the proposed method for analyzing structural frameworks, which is applicable to members with both constant and variable moment of inertia, are the following: (1) advantageous definition for the stiffness of a member, involving not only length and cross section but restraining conditions at the far end, as well; (2) introduction and evaluation of the so-called "degree-of-fixation" at the end of any member, due to the restraining effects of adjacent members rigidly connected thereto, this "fixity" quantity being expressed as a percentage factor lying somewhere between *zero* (for a hinged condition) and *unity* (for a fixed condition), and being independent of the loading on the structure; (3) a simple and exact formula for the "carry over" moment, which is expressed as a factor independent of the loading; (4) development of useful formulas for bending moments in a loaded member in terms of the fixation factors at the ends of the member; and (5) the complete and final process of determining bending moments, and then balancing and carrying over, in only one cycle of operations, applicable to all types of continuous statically indeterminate beams and frames, including also the analysis of moments producing secondary stresses in bridge trusses.

PROFESSOR HICKERSON has directed the following research:

W. M. MCKINNEY. (Progress on master's thesis.) Properties of Members With Variable Moment of Inertia.

This work includes the development of formulas and the compilation of tables giving useful beam and load factors for members with both straight and parabolic haunches and for columns with uniformly tapering sections.

RALPH M. TRIMBLE has completed:

The Size History of a Rapid Sand Filter.

A study of size distribution, shape of grain and origin of extreme sized grains in a rapid sand filter used in water purification. Over the eight-

year life of the unit the size and grading moduli have been determined periodically. During the year additional studies have been inaugurated dealing with encrustation of particles, changes in the size and arrangement of the six one-inch layers at the top of the bed, measurement of the "roundness" of particles in the different layers, changes in "roundness" with continued use, and similar allied problems.

Presented in a paper at the State Board of Health's School-Conference, June 27, 1934.

R. M. TRIMBLE and T. P. NOE, JR., have under way the following joint projects:

Deflection Due to Shear of Steel I-Beams.

Making use of the Theory of Elastic Energy, equations have been developed giving the deflection due to shear of steel I-Beams. These theoretical expressions were derived on the basis of a non-uniform distribution of shearing stress over the cross-section. Limited laboratory tests have verified the theoretical expressions within two per cent. Through the cooperation of the Carolina Steel and Iron Company, of Greensboro, N. C., the experimental study is being extended to include a greater variety of cases.

Experimental Study of Rivet Slip in Riveted Connections.

The results of the shear deflection study are being used in an experimental study of slip in riveted connections.

T. P. NOE, JR., is making a theoretical study of the economic span ratios to be used in Three-Span Cantilevered Highway Bridges.

G. WALLACE SMITH has under way a study pertaining to the analysis of stresses in building frames, particularly the effect of moment distribution in wind bents of tall buildings.

An original method of determining the bending moments in the members of multiple framed structures. The use of fixation factors and the restraining stiffness of the individual members as developed by PROFESSOR T. F. HICKERSON form a basis for developing the method.

PROFESSOR SMITH wrote as a thesis for his master's degree in Civil Engineering at the University of Michigan in 1932: A Modified Method of Moment Distribution for Calculation of Wind Moments in Tall Buildings.

The method of moment distribution as suggested by PROFESSOR HARDY CROSS was used as a basis and from it an empirical formula was developed. This formula and its use were shown to save a considerable amount of time in the solution of moments in multiple framed structures.

A. R. HOLLETT and G. P. EDWARDS have continued their research in Heat Studies on a Separate Sludge Digestion Tank.

COLIN CARMICHAEL is continuing his research on Heat Transfer from Engine Cylinders.

The following master's theses were completed during the year under the supervision of the Department:

COLIN CARMICHAEL. Heat Transfer from Internal Combustion Engine Cylinders. (Under the direction of NEIL P. BAILEY.)

This investigation is an analytical and experimental study of the gas film which adheres to the inside walls of an internal combustion engine cylinder and which protects the wall material from the high flame temperatures attained during combustion. A rational and uniform basis for the calculation of the gas film coefficient of heat transfer is proposed, depending on the average gas temperature throughout the cycle. An experimental technique is developed, and results are given of complete tests made on a single cylinder gasoline engine to determine the effects of variations in ignition timing, air-fuel ratio, speed, and throttle opening.

CHARLES EDWARD FELTNER. Sedimentation Studies on Coagulated Water in an Experimental Water Purification Plant. (Under the direction of GAIL P. EDWARDS.)

An experimental water purification plant to be operated at 6.25 g.p.m. and to include as special features a spirovortex mixing pump and a surfasettler was designed and constructed. The spirovortex pump, placed in the mixing tank, thoroughly mixes the water and chemicals by a rotary spiral motion. The surfasettler differs from the conventional rectangular settling basin in that water may be withdrawn from it either through ports or over a weir. The basin is also provided with an auxiliary floor which allows a change of area factor.

Experiments were carried on over a period of three months to study sedimentation of coagulated water in the surfasettler. Results from the operation of the plant indicate: (a) Doubling the detention period of the surfasettler increases the efficiency about thirty per cent. (b) Reducing the area factor of the surfasettler by one half increases the efficiency about twenty per cent. (c) Withdrawal of water from the surfasettler over a weir is preferable to withdrawal through ports.

A. C. PRAZERES. Grease and Fats in Sludge Digestion. (Under the direction of GAIL P. EDWARDS.)

Various proportions of fresh solids and scum, which contained large amounts of fats and grease, were seeded with ripe sludge and digested. A study was made of the relation between gas production and grease content of sludge, the rate of digestion of ether-soluble matter, the formation of volatile fatty acids and their effect on digestion. The results of the experiments showed that the time required for digestion and gasification of ether-soluble matter is at least 50 per cent longer than that for sludge, a pH of 6.8 or higher should be maintained, and grease and fats are a source of volatile fatty acids, which lower the pH.

DEPARTMENT OF ENGLISH

GEORGE R. COFFMAN has published:

Old Age from Horace to Chaucer, Some Literary Affinities and Adventures of an Idea. *Speculum,* IX: 249-277. 1934.

Review of Owst, G. R., *Literature and the Pulpit in Medieval England. Studies in Philology,* XXXI: 104-109, 1934.

Review of Young, Karl, *The Drama of the Medieval Church. Speculum,* IX: 109-117. 1934.

He has edited Volume XXXI of *Studies in Philology.*

Although PROFESSOR COFFMAN is continuing his work in the medieval and early renaissance drama and on mediaeval saints' material, he is now centering his attention primarily on the study of the literature and the thought of the second half of the fourteenth century in England.

He is directing the following research:

MARY ELIASON. The Third Estate in Chaucer, *Piers Plowman,* and *The Towneley Plays.* (Progress on doctoral dissertation.)

GEORGE C. TAYLOR has published:

Milton's Use of Du Bartas. Cambridge: Harvard University Press. 1934.

PROFESSOR TAYLOR is continuing his studies in Certain Medievalisms in Shakspere.

He is directing the following research:

C. K. BOROUGHS. The English Chronicles. (Progress on doctoral dissertation.)

JAMES HOWELL. Rogues and Vagabonds in Elizabethan Drama. (Progress on doctoral dissertation.)

SADIE F. JENKINS. The Treatment of Tyranny in Elizabethan English History Plays. (Progress on doctoral dissertation.)

ARNOLD WILLIAMS. The influence of Genesis Commentaries on Bacon, Raleigh, and Browne. (Progress on doctoral dissertation.)

J. K. SVENDSEN. Medieval Sources of Milton. (Progress on master's thesis.)

WILLIAM FLINT THRALL has published:

Review of John Revell Reinhard, *The Survival of Geis in Mediaeval Romance. Studies in Philology,* XXXI: 109-112. 1934.

He has in preparation a review article on the currently appearing "variorum" edition of the works of Edmund Spenser (to appear in *Studies in Philology* in 1935), and is continuing his investigation of several minor Spenser topics.

A. C. HOWELL has published:

"Hannibal Scratchy" in Browning's *Pippa Passes. Notes and Queries,* November 18, 1933.

This note points out the fact that Browning hit upon the same nickname for an Italian painter, Annibale Caracci, as did Fielding in *Joseph Andrews,* and conjectures that Browning may have been familiar with the novel.

PROFESSOR HOWELL read before the Philological Club in April, 1934, a paper, Tennyson's "Palace of Art" Revisited.

For abstract, see p. 111.

He is at present engaged in a study of Sir Thomas Browne's humor, with particular reference to the influence of Rabelais on his thought.

The following doctoral dissertations are in progress under the direction of PROFESSOR HOWELL:

BURTON MILLIGAN. Convention and Realism in the Depiction of Rogue Characters in the Non-dramatic Literature of the Sixteenth and Seventeenth Centuries.

DENNIS MURPHY. A Study of Metaphor and Simile in the Works of Certain Major English Poets.

The following master's theses are in progress under his direction:

SUE BRETT. Samuel Pepy's Reading.

LILA M. DAVEY. Thomas Deloney as a Realist.

DOUGALD MACMILLAN has published:

David Garrick as Critic. *Studies in Philology,* XXXI: 69-83. 1934.

This brief study suggests on the basis of examination of critical expressions in the prologues, epilogues, and published correspondence of David Garrick that Garrick was guided in his critical judgment by no fixed principles, though he was in general an excellent judge of popular taste.

PROFESSOR MACMILLAN read a short paper at the meeting of the Drama Group of the Modern Language Association of America in St. Louis, in December, 1933, on The Interpretation of Garrick's Attitude toward Shakespeare.

Aided by a grant from the American Council of Learned Societies, he continued his studies of English drama of the eighteenth century

with particular reference to Garrick in London; and during the year 1934-1935, as the holder of a Huntington Library International Research Fellowship, he is prosecuting the work at the Henry E. Huntington Library, San Marino, California. He is particularly examining for relevant materials the Kemble-Devonshire Collection of plays, the Bridgewater Collection of books and manuscripts, and the Montagu and Jerningham collections of manuscript letters.

ARTHUR PALMER HUDSON, in collaboration with PETE KYLE MCCARTER, of the University of Wisconsin, has published:

The Bell-Witch of Tennessee and Mississippi: A Folk Legend. *Journal of American Folk-Lore,* 47: January-March. 1934.

For abstract, see *Research in Progress,* 1933, p. 35.

PROFESSOR HUDSON has completed Folk-Song in Recent Fiction Describing Southern Life, which he presented in abbreviated form to the Philological Club on October 2, 1934. This essay has been accepted for publication in the *Sewanee Review.*

With the assistance of a General Education Board fellowship grant for the summer of 1934, he has gathered most of the material and projected a plan for a book to be entitled *Humor of the Old Deep South: Anecdotes, Character Sketches, Comic Scenes, and Tall Tales of the Lower River Country, 1777-1860.*

The following doctoral dissertations are in progress under his direction:

KARL G. PFEIFFER. Landor as a Thinker.

CHARLES LEONARD PITTMAN. Wordsworth and Science.

The following master's theses:

MARJORIE CRAIG. The Chivalric Tournament in Southern Literature and Life.

WINNIE A. MURPHEY. The Dejection Theme in Romantic Poetry.

MERCEDES STEELY. Folk-Songs of the Ebenezer (N. C.) Community.

KATHLEEN TYER. The Literary Ballad, 1780-1830.

RICHMOND P. BOND is engaged on the study of Joseph Addison as man of letters and affairs, a bibliography of Restoration and eighteenth-century English literature, 1900-1920, and an edition of eighteenth-century literary criticism.

In the spring of 1935 his edition of selections from the letters and miscellaneous writings of Lord Chesterfield will be published, with introduction, bibliography, and notes.

The following doctoral dissertations are in progress under PROFESSOR BOND's direction:

D. A. BROWN. Crabbe as a Satirist.

J. E. CONGLETON. The Neo-Classic Theory of the Pastoral.

LOUISE LANHAM. The Hymn and the English Evangelical Movement.

M. A. MOORE. Political Eulogy and Satire in English Poetry, 1714-1760.

E. C. MORGAN. The Politics of Joseph Addison.

HENRY RANKIN. John Dyer: Studies in the Tendencies of Eighteenth-Century Poetry.

H. T. SWEDENBERG. The Neo-Classic Theory of the Epic.

ROBERT B. SHARPE is publishing this autumn (1934), as Number V of the Monograph Series of the Modern Language Association of America, *The Real War of the Theaters: Shakespeare's Fellows in Rivalry with the Admiral's Men, 1594-1603: Repertories, Devices, and Types.*

A chronological survey of the theatrical events of Queen Elizabeth's last decade, against a background of happenings at the court and in the nation, which aids the reader in distinguishing the literary policies of the companies and their causes in differences of patronage and audience. Special attention is given to the loyalties of Shakespeare as the chief play-writing member of a coöperative producing group which wore the livery of a place-holding noble.

He has had accepted for publication the following study:

Title-Page Mottoes in the Poetomachia (their Use as Missiles in the Dekker-Jonson Rivalry). (*Studies in Philology.*)

He is continuing his studies in the rivalries of Elizabethan dramatists.

PROFESSOR SHARPE is directing the following research:

CORNELIA HILDEBRAND. (Progress on master's thesis.) Romance Themes in Elizabethan Drama.

ROSAMOND MCCANLESS. (Progress on master's thesis.) Shakespeare's Use of the Unfaithful Wife Motif: His Modifications of his Sources to the Ennobling of his Women Characters.

OLIVE NEWELL. (Progress on master's thesis.) John Fletcher's Clerical Characters.

Robert Douglas Hume. (Progress on master's thesis.) Edward Alleyn, Elizabethan Actor.

H. K. Russell has published:

Tudor and Stuart Dramatizations of the Doctrines of Natural and Moral Philosophy. *Studies in Philology,* XXXI: 1-27. 1934.

The following master's theses were accepted by the Department during the year:

Herbert Allan Anderson. Gothic Elements in the Novels of Charlotte, Emily, and Anne Brontë. (Under the direction of H. K. Russell.)

The purpose of this study is to define and analyze elements in the novels of Charlotte, Emily, and Anne Brontë similar to the elements that characterized the Gothic novels. Major and minor episodes, characters, architectural and natural settings, and technical devices of style were shown to be similar —in a few instances apparently lifted in their entirety from the Gothic novels. The conclusion reached was that Charlotte, who was most indebted to the Gothic novelists, had borrowed from them deliberately; that Emily, whose novel is more thrilling than the Gothic novels, had apparently followed them unconsciously; and that Anne, whose novel of purpose was devoid of imagination, was indebted to the Gothic novels least of all.

Frank Armfield. Influences of Gautier and Baudelaire upon Swinburne. (Under the direction of John M. Booker.)

This thesis started as an inquiry into Baudelaire's influence upon Swinburne—especially upon his artistic ideals—and broadened of necessity to include Gautier's influence and Swinburne's sexual abnormality. The author reached the following conclusions: 1) that he agrees with authoritative scholarship as to Gautier's having introduced Swinburne to the theory of *l'art pour l'art,* despite the fact that in his statements of the theory, Swinburne was more indebted to Baudelaire; 2) that the following elements attributed to Baudelaire's influence by various authors were present in Swinburne's work before he read Baudelaire,—namely, sensuality, sadism, the use of Biblical diction, the desire to shock the public, anti-theism, and his conception of the spirit of man, of Sappho, and of the Tannhauser legend; 3) that Gautier's novel *Mlle. de Maupin* first awakened Swinburne's interest in the themes of sexual ambiguity and the hermaphrodite, and that passages in this novel are sources of Swinburne's "Fragoletta" and his "Hymn to Proserpine."

Henry Edmunds Coleman. Edward Fitzgerald's Translations and their Influence upon his Philosophy. (Under the direction of John M. Booker.)

Contrary to the critical opinion, it was probably not until after Fitzgerald's separation from his wife almost immediately following their marriage, and contemporaneous with his beginning the translation of Omar, that he

became the cynical sceptic reflected in his *Rubaiyat,* which is an "Epicurean Ecologue," as Fitzgerald said, not a philosophical Sufi allegory, as Bjerregaard thought. Previous to his marriage, Fitzgerald probably believed in a benevolent Deity, who created man and to whom he returned in a future life, after a period of discipline in this one—convictions that are fundamentally the same in his four translations, preceding his *Rubaiyat,* of Spanish and Persian works. That the philosophy of the translations was his own philosophy at the time he made them—and possibly the compelling motive for translating them—is indicated by the fact that the first four of the five major translations express fundamentally the same beliefs, noted above, by his careful compression to emphasize their philosophic themes, and by the explanation of a change in his philosophy that his unhappy marriage affords.

ORA UPSHAW DOWNS. The "Original" Dramatic Works of David Garrick. (Under the direction of DOUGALD MACMILLAN.)

This thesis is an investigation of David Garrick as a dramatic author. His acknowledged revisions and adaptations are excluded from this study, and only those plays purporting to be original are treated. Of these there are twenty-one. A detailed analysis reveals five to be adaptations or free translations from the French dramatists Molière, Fagan, Dancourt, LeSage and Favart. Garrick's plays are structurally inferior to the French plays from which he pilfered; the characters are caricatured; the note of "sensibility" is intensified; and a convincing English setting is presented. Seven of the twenty-one plays, while not adaptations, borrow heavily from the works of the English authors, Swift, Fielding, Motteux, Dryden, and the Duke of Buckingham. Garrick took from these English writers such characters, ideas or incidents as he chose, disregarding always the serious satire inherent in the source material. Nine of the plays are, insofar as this study determines, really original, but six of the nine are merely brief sketches, and only the three others reveal any sustained plot construction. Full analysis of Garrick's plays adduces little fresh evidence in his favor as a playwright. His adaptations are uneven, his few original efforts initiated nothing new, although his trivial pieces are acceptable. The variety of Garrick's dramatic productivity is interesting; in the list of the twenty-one plays is found an attempt at every type of stage production acclaimed popular by the theatre audience of the mid-eighteenth century.

KATHERINE HARBIN. Studies in the Poetry of Walter de la Mare. (Under the direction of H. M. JONES.)

Walter de la Mare as a poet is the subject of this thesis. Biographical facts and a chronological list of his prose, poetry, and critical essays are established as a basis for a detailed study of his reading, poetical theory, philosophy, and technique. His formative reading is found to be nursery rhymes, ballads, and the poetry of Blake, Keats, Shelley, Poe, and Christina Rossetti; however, the sources of a poet as he interprets them are the experiences of childhood, ideas engendered by dream, and the emotions of joy, pensiveness, and despair. Poetry may be about any subject, but is essentially

transfused emotion presented with craftsmanship. The philosophy of De la Mare shows a change from escape into dreams to realization of the actual world; perplexing problems are to be ignored in a realization of beauty and making of beautiful things. His diction is enriched by use of archaic words, old forms, proper nouns selected for beauty of sound, and an interest in nature. Ability to write regular metres is shown in his earliest poetry, but scansion based on time units—duple, triple, and tetrameter—is preferred. Rhyme is used almost exclusively, first in couplets or quatrains but later in patterns of his own. Devices of capitalization, hyphenated words, lists, inversions, and alliteration add richness to his style, but in the later poems become mannerisms.

MAUDE MOORE HORNE. The Development of Americanism in James Russell Lowell. (Under the direction of RAYMOND ADAMS.)

The purpose of this study of the development of Americanism in James Russell Lowell is to show that he is not merely a classicist, but that his deeper interests in life were inseparably bound up with his patriotism and his desire for a literary nationality for his country. In order to show his changing concept of Americanism the chronological method has been used, since by that method the development of his Americanism can best be traced.

LOIS JOHNSON. A Study of Willa Cather's Novels of the Middle West. (Under the direction of RAYMOND ADAMS.)

This theory is a critical study of the five novels of Willa Cather which have Nebraska or Colorado as setting. This group was chosen because of the belief that in Miss Cather's picture of frontier life, in her interpretation of the pioneers—especially the immigrant types—and in her study of the effects of American life on these characters and on their children she has made her most important contribution to American art. The thesis includes a sketch of Miss Cather's life in relation to her Nebraska background and a study of the settings, the characters, the structure and the style of *O Pioneers!, The Song of the Lark, My Antonia, One of Ours,* and *A Lost Lady.*

FREDERIC LAWRENCE JONES. The Literary Reputation of Thomas Chatterton. (Under the direction of DOUGALD MACMILLAN.)

In this study an attempt has been made to discover the extent of Thomas Chatterton's posthumous fame and also the several phases through which the reputation of the poet has passed since his death in 1770. The years since that time have been seen as dividing rather easily into four periods: the thirty-three years following Chatterton's death; the period from 1803 to 1837; the Victorian era as a whole; and the twentieth century up to 1930. The conclusions reached were that there had been little actual appreciation of the poet in the first period, that the second marked a general acceptance of Chatterton into the company of poets as well as the high point of his fame, and the third a somewhat backward step due to the prevalence of a sentimental attitude with the interest biographical rather than in the poetry, and the fourth the beginnings of a new critical approach to Chattertonian studies.

PAUL GALLAHAR LONG. An Anatomy of "Wit." (Under the direction of RICHMOND P. BOND.)

"Wit" was one of the most ambiguous and one of the most popular terms in the critical literature of the second half of the seventeenth and the first half of the eighteenth centuries. The purpose of this study is to reduce to order the literature of the controversy which arose from the many attempts to establish the proper signification of serious "wit." A preliminary chapter surveys its extra-critical usage in psychology and in literature, emphasizing those connotations which had most influence upon the formulation of the major critical concepts. The study reveals that the most significant of critical concepts were (1) the fanciful elements in artistic creation, and (2) the product of these qualities plus the disciplining force variously called "judgment" and "reason." Special attention is given to the attitudes of Dryden, Addison, Pope, and Johnson. An appendix defines each use of the term by Pope in his *Essay on Criticism.*

J. MOODY MCDILL. A Study of Milton's Synonyms for the Major Characters in *Paradise Lost*: with Special Reference to Sylvester's Du Bartas' *Divine Weeks,* Caedmon's *Genesis,* and the *Bible.* (Under the direction of G. C. TAYLOR.)

A study of Milton's synonyms for God, the Word, Holy Spirit, Satan, Adam, and Eve shows that embodied in his synonyms, when considered collectively, lies his complete philosophical system of thought as related to each of these characters in turn. An understanding of this disposes of many misconceptions in the interpretation of his ideas in *Paradise Lost.* By comparison, synonyms in Sylvester's Du Bartas' *Divine Weeks* are shown to be inferior to Milton's in dramatic power, compactness of expression, and nobility of conception. Similarly, synonyms in Caedmon's *Genesis* show Milton to have the noble conception of his characters that is found only in earlier stories of man's fall, but they give no proof that he knew Caedmon. The *Bible* also is compared and shown to be Milton's prime source for synonyms.

KNOX MILLER MCMILLAN. Addison vs. Pope. (Under the direction of RICHMOND P. BOND.)

This thesis gives a narrative account of the personal relationship of Joseph Addison and Alexander Pope from their first meeting, in 1712, to Addison's death in 1719. It seeks out the reasons for the quarrel of the two men of letters and finds that it was due to three causes: politics, differences in character, and external actions over which the parties involved had control. Furthermore, the bibliographical problems connected with Pope's satiric portrait of Addison are treated in detail with the conclusion that the famous "Atticus" lines were most probably written in 1715, never shown to Addison, and first published in 1722. Finally, this thesis shows that Pope was more responsible for the quarrel than Addison, as far as the actions of the two men affected their relationship.

MARIETTA WALKUP MCNEER. The Boy as a Character in American Fiction by Standard Authors from Cooper to Mark Twain. (Under the direction of RAYMOND ADAMS.)

This study is an attempt to trace the literary ancestors of Tom Sawyer and Huck Finn through the standard novels of standard writers in the fifty-year period prior to the publication of *The Adventures of Tom Sawyer.* It also attempts to account for the great popularity of the many novels written after *Tom Sawyer* that have as heroes the eternal boy.

This has been done by research in the novels of Cooper, Hawthorne, Davis, Cooke, Alcott, Eggleston, and Aldrich, and in histories concerned with the advance of modern educational and sociological ideas.

WALTER LAUREN MOSES. The Meretrix of English Renaissance Drama. (Under the direction of G. C. TAYLOR.)

This thesis traces the development and successive modifications of a stock character-type from the Mary Magdalene of *The Digby Mysteries* to Dekker's Bellafront and the various imitations of her found in plays written before 1642. It is shown that many of the apparently most naturalistic passages of Jacobean drama, such as the lowlife scenes of Middleton, are the product not of observation but of borrowings, most of which are traced to Dekker and Shakespeare. The Cleopatras of Shakespeare and Fletcher are discussed from the viewpoint of their similarity to the stock type.

VIDA MILLER. Terminology of Supernatural Beings in Chapman, Daniel, Drayton, Marlowe, and Spenser. (Under the direction of W. F. THRALL.)

In this study the poetry and drama of Chapman, Daniel, Drayton, Marlowe, and Spenser have been examined, with attention to the employment of terms denoting the classes of supernatural beings, in an effort to estimate the importance of the supernatural to Elizabethan poets through these five representative figures, and to determine the relative interest in this topic displayed by the individual poets.

The ninety-four words comprising the vocabulary of supernatural beings used by the poets studied are defined, all usages cited, and whenever necessary explained. In thirty instances the *New English Dictionary* has been supplemented by new terms, earlier citations, or added meanings. With the exception of Daniel these poets show a decided attraction for the supernatural, most marked in Drayton, Spenser, and Chapman. All have a preference for the beings of classical mythology as contrasted with those from folk and demonological lore.

WILLIAM LESLIE RADDATZ. Aspects of Characterization as Observed in Some Selected Moralities (including Moral "Interludes") That Are Broadly Theological, Secular or Humanistic, and Controversial in Tendency. (Under the direction of GEORGE R. COFFMAN.)

This study shows the effect upon characterization in certain morality plays of some mediaeval and Renaissance elements: mediaeval elements—allegory, free will, merit and grace; Renaissance elements—interest in learning, in the well-rounded man, in life on earth, as opposed to the mediaeval interest in an afterworld; Reformation elements—religious and political controversy of the time.

Most of these were found to restrict characterization. When the dramatist departed from allegory, his characters usually became more lifelike. If he puts his character in a great, universal situation, however, the character could be both human and allegorical. The Renaissance interest in the well-rounded man brought less one-sided characters freed from the concerns of life after death, but this advance was nullified in some plays by the subordination of character to the excessive interest in learning and to the controversy of the Reformation.

ELISE WILLIAMS ROBERTS. Social Poetry of Elizabeth Barrett Browning. (Under the direction of J. M. BOOKER.)

In her social poems, Mrs. Browning depicts the wretched living and working conditions of England's poor, the resultant brutalization, and the class antagonism. Also, she satirizes negro slavery in the United States. She reacts against social philosophers as inimical to personal freedom, and presents no reform program of her own. She believes in caring for the individual's physical welfare as a means of bettering his soul's welfare, upon which rests the welfare of society as a whole. She wants more of God in the lives of men as a unifying element, and implicit in her work is the application of Christian principles to social reform. The evidence collected from works with a social purpose mentioned in her letters prior to 1856, when her last social poem appeared, shows with varying conclusiveness that she drew upon Dickens, Disraeli, and Mrs. Gaskell for physical background, characters, episodes, incidents, and even plots; upon Carlyle, Kingsley, Mrs. Gaskell, Ruskin, Clough, and Robert Browning, for ideas.

WILLIAM WARREN SILLIMAN, JR. Keat's Use of Tropes Based upon Classical Mythology. (Under the direction of ARTHUR PALMER HUDSON.)

The writer has sought, by means of a classification and an interpretation of Keats' tropes based upon classical mythology, to ascertain their value as indices of the poet's thought and as elements of his poetic style. The tropes have been classified as personifications, similes, hyperboles, implied similes, metaphors, allegories, kennings, synecdoches, metonymies, simple allusions, and massed allusions. The two latter groups are included as tropes (by an extension of the term "trope") because they have figurative value.

It has been found that Keats thought in terms of images rather than of abstractions, because in a majority of cases tropes are used to express the essential thought of the passages in which they occur. Such passages concern especially love, women, literature, mythology, and spiritual matters

(other than love). The imagery he chose in the earlier poems is chiefly from mythology. A considerable decrease in the tropes based upon mythology is perceptible in the later poems. As the shorter allusions to mythology decrease in frequency, the poems using myths as subject matter increase in significance.

CHESTER EUGENE SWOR. The Influence of Latin on the Poetry of Thomas Gray. (Under the direction of RICHMOND P. BOND.)

This paper is based upon the thesis that the Latin influence was one of the strongest factors in the production of Thomas Gray's English poetry. The writer presents, first, a treatment of the poet's thorough training in the Latin language and literature, his personal fondness for the Latin, and his peculiarity of disposition which found a marked affinity in the realm of Latin literature; second, an analysis of the Latin influence in the three periods of Gray's poetical career. Though a decrease in the power of the Latin influence during the last period of Gray's poetry is pointed out, the writer strongly contends that there was not a loss of the poet's affection for classical Latin and that he never relinquished his conviction that the classical mode of expression is superior. The body of the thesis concludes with a discussion of the individual influence of Virgil and Horace on Gray's English poems and with a general summary of the Latin influences. In the appendix there is presented in tabular form an analysis of the English poems of Gray. This analysis lists the passages which show Latin influence, the Latin source or sources for such passages, and translations of the Latin sources into English.

RICHARD GAITHER WALSER. Anti-Catholicism in the Gothic novel. (Under the direction of A. P. HUDSON.)

This study has been made in order to show that anti-Catholicism was an unmistakable element of the Gothic romance. From eighteen novels, by Horace Walpole, Clara Reeve, Ann Radcliffe, Matthew Gregory Lewis, William Godwin, Percy Bysshe Shelley, Mary Shelley, and Charles Robert Maturin, evidence has been cited to indicate these writers' aversion for the Catholic church. In the works of the first four authors named, the antipathy was subordinated to the writers' interest in Catholicism for its aesthetic values. In the works of the latter four, the authors were more expressly purposeful in their attack, often writing long argumentative passages against the customs and beliefs of the church. It is shown that the contemporary dislike for Catholicism in England was partly responsible for the disfavor that Catholicism received in the representative Gothic novels.

The following doctoral dissertations were completed during the year under the supervision of the Department:

JAMES OSLER BAILEY. Scientific Fiction in English: 1817-1914. A Study of Trends and Forms. (Under the direction of JOHN M. BOOKER.)

The development of science has been accompanied by the growth of a literature, scientific fiction, whose theme is the imaginative interpretation of science. Scientific fiction concerns imaginary invention or discovery in the natural sciences and consequent adventures. This study, based upon several hundred prominent and typical romances, examines the trends and forms of scientific fiction in English (including translations from foreign authors) between the years 1817, the date of publication of Mary Shelley's *Frankenstein,* and 1914, the date of publication of H. G. Wells's *The World Set Free.*

Scientific adventure was described before the nineteenth century in travelogues, utopias, and satires. With the "Gothic" revival that accompanied the Romantic movement, science and supernaturalism became associated in fiction, forming a persistent "Gothic" strain in *Frankenstein* and later romances dealing with science. During the period 1817-1870 Edgar Allen Poe and Jules Verne, in the main describing interplanetary and geographic adventures or wonderful inventions of the future, made scientific fiction widely popular. Their treatment of science, however, was largely facetious or purely adventurous. The theory of evolution was first prominently reflected in fiction in Bulwer-Lytton's *The Coming Race* (1871), an "instrumental utopia" describing the future evolution of the race and the benefits of the increasing use of machinery. Samuel Butler's *Erewhon* (1872) satirically asserted that the development of machinery would not result in utopia, but in man's becoming a machine-minder at the expense of his human qualities. During the period 1871-1894 a large number of utopias and satires appeared debating the problems stated in *The Coming Race* and *Erewhon.* The theory of evolution inspired a large number of "historic romances" set in the prehistoric past or the far-distant future. The implications of science that the place of man in the universe is a relatively insignificant one are reflected in Wells's *The Time Machine* (1895), a romance looking forward eight hundred millenniums and describing man in cosmic perspective. From 1895 to 1914, the production of scientific fiction was highly accelerated; the themes were widely varied in books as different as Wells's serious studies and the most superficial dime novels. Since 1914 scientific fiction has appeared in an increasing number of serious studies, as well as in magazines, popular "thrillers," and moving pictures.

Structurally scientific romances usually follow a formula. They pay little attention to the unities, including great masses of material extraneous to the adventure described; they use ingenious devices to induce belief in the marvels described; and they are weak in characterization, romancers taking refuge in such stock characters as "Byronic" heroes, eccentric scientists, and the "eager pupils" of the utopias. In content, scientific fiction ordinarily varies little from a stock pattern: An adventurer reaches a strange world —distant planet, the future, or the interior of the earth; and through a host, whose daughter he afterwards marries, he becomes acquainted with the language, customs, and history of the alien world. Scientific fiction describes many marvelous machines, which most often are perfected developments of mechanisms being experimented upon at the time of publication.

For example, marvelous uses for electricity and such machines as the airplane and the submarine are described from the 1860's onward. Most scientific fiction is not, however, facetious. It has sought to interpret imaginatively the implications of science for the future of mankind. It earnestly proclaims the necessity for a synthesis and interpretation of the disparate facts revealed by science, and for the social use of machinery. The philosophies set forth constitute a debate concerning human destinies, the utopians declaring that science will make possible a golden age in which a race of supermen will abolish war and in which the world's goods will be bountifully and equitably distributed; the satirists declaring that man will degenerate through the use of machinery, and that the weapons provided by science will eventually destroy society.

The bibliography of scientific fiction, listing about 1000 titles, is unique. An Appendix describes the method of its formation.

FRANKLIN PIERCE CAUBLE, JR. William Wirt and His Friends. A Study in Southern Culture, 1772-1834. (Under the direction of GREGORY L. PAINE.)

The purpose of this study is to make an investigation of the literary and cultural activities of William Wirt and his professional friends who lived in and around Richmond, Virginia. Wirt had many interesting friends but his closest literary associates were Dabney Carr, Frank Carr, Francis Gilmer, Louis Hue Girardin, Thomas Jefferson, Richard E. Parker, Henry St. George Tucker, Judge St. George Tucker, and David Watson. Although considerable biographical and background material is introduced, little attention is given to the professional careers of these men.

Wirt and his associates were not an isolated group untouched by much that was going on in the world, but their minds were strongly colored by the changing tastes, the rapidly shifting currents of thought, and the cultural background of their period. Their writings clearly reveal, during the first two decades of the nineteenth century, the steady development in the Virginia mind of a romanticizing attitude toward the past. This appears in *The Rainbow* and *The Old Bachelor* and receives its fullest expression in the *Sketches of the Life and Character of Patrick Henry.*

A large amount of new material, including uncollected periodical essays, letters, and a poem, is presented in this study. Instead of only one series of essays being published in *The Rainbow,* as is usually stated, there were three, the latter two uncollected. These uncollected papers reveal in a most interesting manner both the attempt and the failure of Virginians to uphold the ideals of Jeffersonian democracy in a social order maintaining a system of slavery.

In connection with the interest of Wirt and his friends in the Richmond Theatre, a survey is made of the plays presented in Richmond from 1786 to 1811. The use of the foreign-observer device in English and American literature is discussed in the chapter dealing with *The Letters of the British Spy.*

During the latter part of his life and for several decades thereafter, Wirt was more highly regarded for his oratorical ability than for his literary productions, but he has now achieved a secure place in American literary history as a pioneer essayist and biographer. His efforts to overcome the indifference of other members of his circle and to prod them into literary activity largely were wasted. But it should not be forgotten that the high estimate which Wirt's friends always placed on his ability as an author spurred him to produce much more than he would have done if he had not been so closely associated with them.

JOHN STEWART DAVENPORT. The Ode in American Literature. (Under the direction of GREGORY L. PAINE.)

This study was undertaken in an effort to determine how successive generations of American poets regarded the ode and to trace this lyric form from its beginnings in America to the present day. In the opening chapter a definition is formulated and an examination made of the odes of Pindar and Horace. The second chapter briefly traces the main outline of the development of the English ode.

In America between the years 1750 and 1815 a large number of odes, poetically undistinguished but genuinely and fervidly patriotic, was written. The next period from 1815 to 1845 shows a decline in numbers but a swift rise in merit. Both in quantity and quality the American ode reaches its height in the middle decades of the nineteenth century with Emerson, Lowell, Stoddard, Boker, and Timrod as the leading exponents. After 1870 there was a gradual decline in the number of odes written and, with a few brilliant exceptions, in the quality of the poetry that they contain.

This study of the American ode reveals the use of four main verse forms: the Pindaric, the Horatian, the irregular, and the long stanzaic. The prevailing form changes from period to period, but the irregular structure comes gradually to be recognized as the accepted, though not the exclusive, medium of expression. In respect to subject matter the nationalistic-patriotic poem has from the first dominated the field. In the early period such a poem was often intended to be sung. Frequently before, but especially after, the War of 1812 the patriotic theme has been united with the occasional purpose of an ode. Without doubt the ode has been the lyric form most generally utilized for celebrations, memorials, anniversaries, and similar occasions. Nature themes and personified abstractions are, however, often the subjects of these poems, and meditative or philosophic odes are likewise repeatedly found.

Genuine feeling, real imagination, and vigorous thinking are all characteristics of the best odes. Two distinct and very different styles of writing develop; one distinguished by a profusion of images, an impetuous movement, a rich and forceful diction; the other by high thinking, severe restraint in movement, and the utmost simplicity of rhetorical effects. By means of either of these styles, elevation and sublimity—the aim of most ode writers—may be achieved.

Among the writers of distinguished odes, in addition to those already mentioned, are Nathaniel Evans, Bryant, Charles Sprague, Taylor, Stedman, Lanier, Hovey, Moody, Robinson Jeffers, and Edna Millay.

GEORGE FRANK SENSABAUGH. John Ford—An Historical and Interpretative Study: With Special Reference to Burton's *Anatomy of Melancholy* and to the Court of Henrietta Maria. (Under the direction of GEORGE COFFIN TAYLOR.)

The purpose of this dissertation is threefold: (1) to show the influence of Burton's *Anatomy of Melancholy* upon Ford's plays; (2) to show the influence of the Platonic cult in the Court of Henrietta Maria; and (3) to show how a fusion of these influences produced a modern type of drama, the problem play. These combined aims make possible a re-interpretation of Ford's drama through a study of his creative processes. This dissertation also has four minor aims: (1) to find new data concerning Ford's life; (2) to review preceding source studies; (3) to establish as clearly as possible the Ford canon; and (4) to compile a Ford bibliography approaching completeness.

The thesis proper contains five chapters. Chapter I contains a rearrangement of Ford's genealogy and adds a few new facts to his biography. Chapter II presents a review of preceding source work on Ford and justifies a new approach to his drama through a study of the influences of *The Anatomy of Melancholy* and of the Platonic cult in the Court. Chapter III traces completely the influence of Burton upon Ford, and shows how he took from Burton terminology, ideas for character portrayal, and a plot structure based upon the causes, symptoms, prognostics, cures, and results of pathological melancholy. As a result of this influence Ford's drama thus becomes diagnostic and realistic. Chapter IV shows the influence of the Court,—an influence which gave to Ford the twisted idealism of Court Platonic theorizing. In the Court Ford found his code of ethics, a code which justified and deified unrequited love, adultery, and incest. As a result of this influence his drama becomes idealistic. Chapter V interprets these two influences. It shows how a fusion of the medical realism of Burton and of the Platonic idealism of the Court raises problems not differing greatly from the problems put forth by modern writers; how Ford presents realistically ideals that are at variance with conventional morality. His three problem tragedies thus propound the thesis that individual rights are superior to the rights of society. This interpretation—that Ford is a writer of ideas and problems—puts a new value on his drama and lifts him from the levels of preceding criticism that has designated him as the most decadent of the decadents.

The appendix contains a discussion of the Ford Canon. The bibliography contains (1) a list of the editions of Ford's works, chronologically arranged; (2) a list of studies directly connected with Ford and his works; and (3) a list of studies and books consulted in connection with the whole thesis.

MITCHELL PRESTON WELLS. Pantomime and Spectacle on the London Stage, 1714-1761. (Under the direction of DOUGALD MACMILLAN.)

An attempt is made in this study to place the English pantomime of the eighteenth century in a clearer light than has been thrown upon it in previous studies and to relate it to theatrical conditions in its time. The period chosen for study, 1714–1761, the active career of the founder of the type, not only contains the true origins and the complete development of the form but also witnesses its establishment as a permanent feature of English theatrical entertainment. The eighteenth-century pantomime was a hybrid whose origin is closely associated with the name of John Rich, who, under the stage name of Lun, established the dramatic form known today as pantomime. This study is based upon an examination of all the pantomimes published in the period under discussion, the playbills, dramatic notes, and clippings of the Burney, Dyce, and Enthoven collections, the newspapers, memoirs, and histories of the period. It establishes in the first place that by the word "pantomime" the eighteenth century meant in general an entertainment consisting of a "serious" mythological story told by means of dance, song, and recitative, interspersed with a "comic" story based on the exploits of Harlequin portrayed entirely by dumb show. Song, dance, and spectacle, with various magic effects, were emphasized.

In consideration of the origins of the type, the growth of spectacle on the English stage is briefly indicated and the chief forerunners of the English pantomime found to be four in number, namely: (1) native English clownage, song, and dance; (2) the *commedia dell' arte;* (3) the masque; (4) the Davenant type of dramatic opera.

On the general formula for the eighteenth-century pantomime there were many variations. These variations and the several distinct types of pantomime developed between 1714 and 1761 are studied. The pantomimes of the period are shown to fall logically into seven well-defined groups, each of which is discussed in detail.

The next point treated is staging. Stressing spectacle as it did, the pantomime provides some of the most striking instances of ingenious stage managing to be found in the courses of English drama. The use of various mechanical novelties, sudden transformations, animals (both real and artificial), and striking scenic effects is studied by means of stage directions and through contemporary newspaper comment. The theatres found such devices to be unusually profitable, and this contemporary reaction is next discussed. Periodical comment, both favorable and unfavorable, is submitted as evidence of the popularity of the pantomimes and an effort is made to explain the part of pantomime in the frequently mentioned parlous state of the early eighteenth-century theatre. The pantomime is shown to be a true product of its age, being a logical development of the dramatic and social tendencies of the time The mutual relations between pantomime and other dramatic forms are pointed out, and a definite influence of the pantomime on the dramatic offerings of the time is demonstrated.

Appended to the study is a handlist of all pantomimes produced in this period with a summary of each pantomime where such is available and a record of performances based on the newspaper advertisements and playbills of the time. This handlist contains many items unnoted in previous lists.

VIOLA CHITTENDEN WHITE. Symbolism in Herman Melville's Writings. (Under the direction of GREGORY L. PAINE.)

The purpose of the study is to indicate the significance of Melville's symbolic books as aspects of his religious consciousness. The treatment of the theme divides itself into three sections. The first section contains definitions of symbolism and allegory, a survey of scholarly and critical studies of Melville's writings, and a discussion of his literary sources. The second section contains a discussion of the symbolical elements in *Mardi, Moby-Dick, Pierre, The Confidence-Man,* and *Clarel.* In *Mardi* love is won at the cost of violent conflict with earth's religion. Happiness cannot be found in social and political institutions of contemporary civilization, and exists only in Serenia, the ideal Christian commonwealth. In *Moby-Dick* rebel man attempts, with suicidal results, to array his power against the power of the Omnipotent. In *Pierre* the mortal endeavor to rival heavenly virtue results in both inner and outer disintegration. In *The Confidence Man* the charity that thinks no evil encourages charlantanism. In *Clarel* Christian faith is dead, and Science offers no solution for man's loss of it. The third section presents Melville's ideas in relation to certain aspects of Romanticism, such as Naturalism, the Theory of Progress, Science, Democracy, the Transcendentalism, for the purpose of showing how these ideas colored his religious thought. Despite his somewhat distrustful attitude toward Mother Nature, his portraits of the Noble Savage, and his contrasts between simple and civilized communities reveal his primitivism. Melville's Golden Age lay in the past; he was hostile to the theory of progress, and saw in science, allied with industrialism, a possible menace. Although, with some misgivings, he believed in political democracy, his social democracy was based upon the realization of man's universality in misfortune, not upon belief in common man's achievement. Although he played with a few transcendental ideas, he was not a transcendentalist. The conclusion is reached that Melville's religious ideas, as expressed in his symbolic writings, derive their negative and pessimistic coloring, not from autobiographic sources, but from the influence of Romanticism.

DEPARTMENT OF GEOLOGY

WILLIAM F. PROUTY has completed the following research:

Meteor Craters of the Carolinas. Abstract in *Elisha Mitchell Journal,* L: 48. 1934. To be published by the *Journal of Geology.*

During 1933 and the spring of 1934 a party from the geology department consisting of W. F. PROUTY, G. R. MACCARTHY, and J. A. ALEXANDER made several reconnaissance trips in central and northeastern South Carolina and southeastern North Carolina. Cross sections of the Coastal Plain were made with the magnetometer and many readings and geological observations were taken in the areas of the elliptical-shaped bays and lake basins. The magnetometer readings in connection with most of the elliptical bays and lake basins show a marked high anomaly generally a little east of south from the south-

east end of the bay or lake basin and at a distance about equal to the short dimension of the ellipse. The magnetometer readings as well as general geological observations tend to support the meteoric origin of these elliptical-shaped bays and lake basins.

Fossil Whales of North Carolina—Miocene. Abstract in *Elisha Mitchell Journal*: L: 52. 1934.

Fossil remains of Middle Miocene whales have been secured from several localities in North Carolina from the Yorktown Formation. The most fossiliferous horizon so far discovered outcrops northeastwardly from Tarboro. Near Tarboro a nearly complete skeleton was uncovered with lower jaw bones 13½′ long. Two other important localities are Fishing Creek northeast of Tarboro, and Kirby Creek near the east line of Northampton County.

A continuation of the research in the Silurian Stratigraphy of Eastern Tennessee has been carried on throughout the year and the report is to be published as part of *Silurian of North America* by the National Research Council.

PROFESSOR PROUTY is continuing his studies as to the origin of the elliptical bays and lake basins in the Carolinas.

He is supervising the following research:

ROSS HORNBECK. Topographic and geological map of a portion of Morgan Creek Basin.

RICHARD A. EDWARDS. Sedimentary Petrology of Durham Basin Triassic.

J. W. SMITH. World Cotton Cultivation Production.

GERALD R. MACCARTHY has published during the year:

Calcium Carbonate in Beach Sands, *Sedimentary Petrology,* III: 64-67. August, 1933.

Two papers are now in preparation, one dealing with windblown sands, and one dealing with magnetic observation in the Coastal Plain of North and South Carolina.

PROFESSOR MACCARTHY is continuing his geophysical investigation of the Carolina Coastal Plain and also an investigation on the physical properties of sands of various origins.

He is directing the following research:

H. W. STRALEY, III, and W. R. JOHNSON, JR. A Magnetic Survey of the Durham Basin.

JOHN W. HUDDLE has completed the following research:

Conodonts from the New Albany Shale of Indiana. *Bulletin of American Paleontology,* XXI: 21. 1934.

The study has involved the collection, description and illustration of the Conodonts from the New Albany shale of Indiana. Conodonts are a group of extinct organisms of uncertain taxonomic position, but were probably primitive fish-like organisms closely related to the Cyclostomata. Evidence is presented in regard to the probable taxonomic position of Conodonts; and the morphology and phylogenetic relations of some of the genera are discussed. The Conodonts found and described from the New Albany shale belong to 3 families, 20 genera, and 158 species. Four of the genera and 121 of the species are new. The families of Conodonts have been revised and one new family proposed. The stratigraphy of the New Albany shale is discussed and some suggestions as to its correlation are made.

PROFESSOR HUDDLE has the following studies in progress:

Taxonomic study of the Conodonts of the Chattanooga shale of the Central basin of Tennessee.

Stratigraphic relations of the New Albany and Chattanooga shales.

A reclassification of the Order Conodonta based on internal microscopic structures.

He is supervising the research in connection with the master's thesis of J. C. McCampbell, A Foraminiferal Study of a Miocene, Yorktown, Formation of North Carolina.

SAMUEL T. EMORY is continuing his study of North Carolina as a Transition Crop Region.

I. L. MARTIN has in preparation his doctoral dissertation:

Petrographic and Micro-Paleontological Correlation of the Coastal Plain Formation of Eastern North Carolina.

DEPARTMENT OF GERMAN

E. C. METZENTHIN has expanded the scope of his investigations in regard to Old Germanic manuscripts, adding the study of the *preparation* by the copyists of their writing material. During the academic year he compared letter by letter the reproductions of the fragments of Otfrid's *Liber Evangeliorum,* bought through the Smith Fund for the Library. During the summer of 1934 he spent two weeks each at Bonn and Berlin, studying the same fragments in their original form. He had the privilege of comparing these two fragments side by side, through the generosity of the authorities at Bonn, who for the first time permitted these documents to leave Bonn. The same fragments he had reproduced by the official photographers, to be deposited in the Library of the University of North Carolina, the expenses being paid

by the Smith Research Fund, and to be used during the new academic year for further comparisons.

DEPARTMENT OF HISTORY AND GOVERNMENT

R. D. W. CONNOR has published:

William Gaston: A Southern Federalist of the Old School And His Yankee Friends, 1778-1844. *Proceedings* of the American Antiquarian Society, October 18, 1933. New Series, Vol. 43, Part 2.

H. M. WAGSTAFF has published:

The Minutes of the North Carolina Manumission Society, 1816-1834. *James Sprunt Historical Studies,* 22: 1 and 2. 1934.

W. W. PIERSON has written and had accepted for publication:

Foreign Influences on Venezuelan Political Thought, 1830-1930, an article which will appear in *The Hispanic American Historical Review.*

He has also completed the preparation of an article on The Works of Francisco Arango y Parreño.

He has published reviews of N. A. N. Cleven's translation of C. Parra Pérez's *Bolívar: contribución al estudio de sus ideas políticas (The Hispanic American Historical Review,* 1934) and of José Santiago Rodríguez, *Contribución al estudio de la guerra federal en Venezuela* (*American Historical Review,* 1934).

M. B. GARRETT expects to publish during the year a small volume entitled The Estates General of 1789: The Problems of Composition and Organization.

PROFESSOR GARRETT has half completed a textbook on the History of Western Europe, 1500-1815.

W. E. CALDWELL is preparing for publication in 1935 *A Short History of Medieval Europe.* (With LOREN C. MACKINNEY.)

L. C. MACKINNEY has published during the year:

Tenth-Century Medicine as Seen in the Historia of Richer of Rheims. *Bulletin of the Institute of the History of Medicine.* Johns Hopkins Hospital, II: 347-375. 1934.

A study of medical literature, education, and practice in Northern France (Chartres and Rheims in particular), based on the passages in Richer's Historia that deal with medicine, and studied intensively from the standpoint of existing manuscripts of the tenth century. The manuscript background was

studied during a portion of the summer of 1933 at Chartres and Paris, as a result of a grant from the Smith Research Fund. The Latin text (with English translations) is given, in the case of all medical passages from Richer, and related sections of the extant manuscripts. The value of this paper is the light it sheds on the schools, manuscripts, and practice of medicine in a part of Europe that has been considered "dark" and "barbaric" during the tenth century. The evidence presented indicates that there was a well developed school of classical medicine in Northern France, and that classical influences existed during the "dark ages," probably in an unbroken line of succession from Roman times.

PROFESSOR MACKINNEY has ready for publication:

Medieval Medical Dynamidia.

A study of a little-known type of early medieval handbook of medicine; tracing the development of books of dynamidia (*i.e.*, the powers of medicines) from the Works of Hippocrates, and also from pseudo-Galenic writings. This study was made possible by a summer of research in France and by photostats, both provided through a grant from the Smith Research Fund.

He has in progress:

Medieval Medical Concordances (now in rough draft and being held up until further research in Europe in 1935 makes possible a more definitive conclusion to the work).

A study of alphabetically arranged medical handbooks of the early middle ages.

With FRANCES HARPER he is preparing:

The Correspondence of Fulbert of Chartres (listed for publication as one of the volumes of the Columbia University series entitled *Records of Civilization,* to be completed in 1934-35).

Translations, with critical comments, of the letters of Bishop Fulbert of Chartres (died 1028), with an introduction concerning his life and labors.

PROFESSOR MACKINNEY has published book reviews in the *American Historical Review* and in *Speculum.*

He is preparing, in collaboration with W. E. CALDWELL, *A Short History of Medieval Europe,* to be published in 1935.

W. S. JENKINS has ready for publication with the University of North Carolina Press, *Pro-Slavery Thought in the Old South: An Historical and Analytical Study of the Mind of the Slaveholder.*

He has prepared a paper to be read before the North Carolina Historical and Literary Society: Ethnological Arguments in Defense of Slavery.

JOSIAH C. RUSSELL has published during the year:

The Preferments and *Adiutores* of Robert Grosseteste. *The Harvard Theological Review,* 161-172, July-October, 1933.

He has had accepted for publication *The Shorter Latin Poems of Henry of Avranches Relating to England,* an edition in collaboration with PROFESSOR J. P. HEIRONIMUS of the University of Wisconsin. It will be published by the Mediaeval Academy of America.

In England during the summers of 1933 and 1934 on grants from the American Council of Learned Societies PROFESSOR RUSSELL brought near completion his study *The Writers of Thirteenth Century England.*

CECIL JOHNSON has published:

The Distribution of Land in British West Florida. *The Louisiana Historical Quarterly,* October, 1933.

Expansion in West Florida. *Mississippi Valley Historical Review,* March, 1934.

C. H. PEGG has published:

Sentiments Républicains dans la Presse Parisienne lors de la fuite du Roi à Varennes. *Annales historiques de la Révolution Française,* 65: 5. 1934.

The following master's theses were accepted by the Department during the year:

ROBERT MAYNE ALBRIGHT. The Development of Powers and Duties of the Governor of North Carolina Under the Constitution of 1868. (Under the direction of R. D. W. CONNOR and E. J. WOODHOUSE.)

This thesis attempts to trace the office of governor of North Carolina from 1663 to 1932, with particular emphasis on the development of the powers and duties of the governor since the adoption of the Constitution of 1868.

The governor of North Carolina has been generally considered the least powerful of American state executives, but since 1915 the tremendous increase in his control over the administration and his increasingly effective leadership in legislation have made him a powerful executive in spite of his lack of legal powers. A suspensive veto, a shorter ballot, and more complete control over a centralized administrative system are still necessary to make him the real head of state government; but even without these powers, the governor today has more influence and power than he has ever enjoyed in the past because he has learned to make effective use of the powerful influence of popular support.

WELDON AMZY BROWN. Attempts at Reconciliation between Great Britain and her Colonies, 1774-1779. (Under the direction of R. D. W. CONNOR.)

This study involves an analysis of the official attempts at reconciling the differences between the mother country and her American colonies. Only those efforts which were made either by the Continental Congress or the proposals offered by the ministry and accepted in Parliament are considered. The solution offered by the Continental Congress was simply a return to the conditions before 1763. The efforts made by the mother country involved three main plans: Lord North's plan of 1775, exempting from parliamentary taxation any colony that would give a fixed sum of money for the common defense of the empire, to be at the disposal of Parliament, and fix an adequate appropriation for the support of its own civil government; the offer of the Howe peace commission of 1776, which proposed to grant pardons to the colonists individually or collectively upon their request for it; and Lord North's propositions of 1778, ceding everything but absolute independence, and virtually repealing the Declaratory Act of 1766. The Carlisle peace commission vainly tried to induce the colonies to accept this final plan, but it was then too late. The failure of the second petition to the King in 1775, the beginning of the war, the Declaration of Independence, and the French-American alliance doomed to failure any plan after 1776 short of absolute independence.

Before 1776 the mother country, and especially the King and his ministers, did not think the colonies would or could effectively resist British force. It was not until Burgoyne surrendered that the ministry realized that America was serious and that the empire was actually breaking up. Had the ministry foreseen this danger earlier they would have made genuine concessions before it was too late.

SALLY MILTON CARTER. The Ballinger-Pinchot Controversy. (Under the direction of W. W. PIERSON, JR.)

This thesis attempts to present the background of, the incidents in connection with, and the political results of the Ballinger-Pinchot Controversy which took place during the administration of President Taft.

The economic and political background of the controversy is presented in a discussion of the conservation movement during the administration of President Roosevelt. Conservation legislation under President Taft is analyzed and the different views in regard to conservation held by Gifford Pinchot and Richard A. Ballinger are shown to have resulted in a Congressional investigation of the Interior Department and Forestry Bureau. The report of the Congressional committee of investigation, exonerating Ballinger of the charges preferred against him, is given, and the fact that the controversy had grown from conservation principles, and was now in the field of general politics, is stressed.

The conclusion is reached that Ballinger was not an enemy of conservation as was charged, and that the controversy, while assuming the nature of a fight over conservation principles, was in reality essentially political, as it was one of the big factors contributing to the division in the ranks of the Republican party and the defeat of that party in the election of 1912.

RACHEL CORDLE. The Decline of the Knights of Labor with Special Reference to the Haymarket Riot. (Under the direction of W. W. PIERSON, JR.)

This thesis is a study of the Haymarket riot, which occurred May 4, 1886, and the Anarchist case, and of other closely related factors which produced the decline of the Knights of Labor. In 1885 the Knights of Labor were at the height of their power. By 1890 they had lost their influence as a labor organization. The rapid decline of the order was largely due to the effects of the Haymarket riot and to the conflict of the Knights of Labor with trade unions and the American Federation of Labor. The introduction traces the rise and analyzes the organization of the Knights of Labor. Chapter I describes the Haymarket riot and studies the trial of the "Anarchists;" Chapter II traces their effects upon the Knights of Labor; and Chapter III analyzes the conflict with the trade unions and the American Federation of Labor. Chapter IV traces briefly the failure of the Knights of Labor as a political force and summarizes the decline of the order.

LETITIA WOMACK CURRIE. The Organization and Method of the League of Nations in Reference to the Problem of International Communications and Transit. (Under the direction of K. C. FRAZER.)

The problem here considered is that of the portrayal of the development of the method and procedure of the League of Nations in meeting the task imposed upon it in regard to international communications and transit. The various League agencies, parts of the general organization, are considered in the light of the rôle that each plays in the preparation of rules and their application by the Member States. The Advisory and Technical Committee, The Technical Sub-Committees, the Special Conference, and the General Conference are treated as institutions directly related, as parts of a whole process. This process is, in brief, the preparation and making of international legislation providing increased opportunities for international communications and transit.

FAY ROSS DWELLE. Medicine in Merovingian and Carolingian Gaul. (Under the direction of L. C. MACKINNEY.)

An analysis of medicine in Merovingian and Carolingian Gaul has shown that there was a decided improvement in this science and in the status of doctors in the latter period. An interest in abstract theories of disease is revealed. Ideas of causation of disease show a distinct tendency to understand physiological phenomena and its relation to disease. Yet Merovingian accounts of diseases are more detailed, and reveal a remarkable degree of intelligence. Carolingian remedies show an emphasis on physical methods in contrast to the preponderance of miraculous cures recorded in Merovingian works. Even preventive methods of treatment were employed. Medicine itself held a place of equal importance with the seven liberal arts in the curriculum. Carolingian doctors were more respected than those of the Merovingian period, and had greater educational opportunities. Carolingian hospital plans suggest the possibility of medical specialization.

John Stanley Frazer. The Second Venezuelan Crisis and the Question of the Forcible Recovery of Public Debts. (Under the direction of W. W. Pierson, Jr.)

This is not an attempt to re-evaluate the political side of the attempt of Germany, Great Britain, and Italy to collect claims from Venezuela, but rather an effort to indicate the connection of the crisis with the note of Dr. Drago, Argentine minister of foreign affairs, on the subject of public debts. From the writings of Drago, from official records, and from works of publicists incident to the international debate on the subject of forcible collection of public debts, this study tries to show how far the Drago Doctrine was sound and how far it succeeded. The discussion of the subject in the Third Pan-American Conference and the Second Hague Conference is indicated, with the final adoption of the Hague Convention providing arbitration in cases of contract debts, which owes its origin chiefly to the note of Dr. Drago.

William H. Gehrke. The German Element in Rowan and Cabarrus Counties, North Carolina. (Under the direction of R. D. W. Connor and H. McG. Wagstaff.)

Beginning about 1747 and continuing until approximately the close of the eighteenth century, Germans who had emigrated to Pennsylvania from the Palatinate, Würtemburg, and other provinces of Germany because of unsatisfactory religious and economic conditions trekked to the region later embraced by Rowan and Cabarrus counties and founded settlements along Second, Dutchman's, Abbott's, and Dutch Buffalo creeks.

Farmers of superior abilities, they began planting cotton immediately upon their arrival in the South, though at all times they carefully diversified their crops. They ushered in a new era in agriculture in the State by introducing meadows, practising soil conservation, and by founding both the Rowan Agricultural Society, the first in the piedmont of North Carolina, and the Board of Agriculture of North Carolina.

Edward Kidder Graham. The *De Universo* of Hrabanus Maurus: A Medieval Encyclopedia. (Under the direction of L. C. MacKinney.)

The *De Universo* of Hrabanus Maurus, an encyclopedic work of the ninth century, is essentially the result of a church scholar's effort to establish the relationship between religious and secular learning. Based largely on the *Etymologiae* of Isidore of Seville, it presents certain marked differences which give it a unique character. The first five books, which deal with religion, are more detailed than the corresponding portion of the *Etymologiae,* while the secular books contain far less factual information than does the earlier work. The most important phase of the *De Universo* is the exegetic, or the "mystical" explanations of the subjects considered. The "natural" explanations are secondary. This encyclopedia made no contribution to the fund of knowledge extant at the time it was produced. Its most important contribution was its method of arrangement, which seems to have been followed by later writers.

RUFUS FRANKLIN JOHNSTON. The United States and the Panama Congress of 1826. (Under the direction of FLETCHER M. GREEN.)

The purpose of this paper is to make an intensive study of the relation of the United States to the Panama Congress, and the controversy it caused in Congress and the press. A brief discussion of the origin and work of the congress is first given. The part played by John Quincy Adams and Henry Clay in the proposed congress is discussed at length, and the controversy in the Senate and House of Representatives is given in detail. An attempt is made to ascertain the attitude of the press in regard to the Panama Mission as it reflected public opinion. The conclusion is reached that the chief significance of the congress and controversy, as it relates to the United States, is found in the effect it had upon politics, and especially its effect upon the organization of the Jacksonian Democratic party.

JAMES MILLER GRIMES, JR. Literary Evidences of Graeco-Roman Relations Before 264 B. C. (Under the direction of WALLACE E. CALDWELL.)

This thesis is a study, based on the literary evidences, of the relations between Greece and Rome prior to the outbreak of the First Punic War (264 B. C.). The subject naturally divides itself into two periods, the Regal Period and the Republican Period before 264 B. C. The stories which contain evidence of relations are analyzed to ascertain their truth and to discover which contain proof of actual contact between the two civilizations. The trustworthy evidence seems to indicate that the relations were almost wholly due to trade and that this trade brought with it elements of Greek culture which exercised great influence on Rome, especially in the fields of religion and law.

RUTH GREGORY MCAULIFFE. The Commerce of Royal Georgia. (Under the direction of C. C. CRITTENDEN.)

This study deals with the trade of Georgia during the years of royal control. A background is given by a treatment of the economic influences in the settlement of the colony. In 1752 Georgia came under the direct control of the crown and from then on great emphasis was laid on her material benefit to the mother country. During her twenty-six years under the king, the colony established trade relations with Great Britain, the British West Indies, and the continental colonies. Georgia's principal exports to these places were of the extractive type: rice, indigo, lumber, naval stores, deerskins, and pork and beef. Her leading imports from these regions were sugar, rum, Negroes, flour, bread, salt, and manufactured articles. By the time of the Revolution, Georgia held a definite place in the commercial life of the First British Empire.

MARGARET CALLENDAR MCCULLOUGH. Work of Dorothea Lynde Dix for the Insane, 1841-1861. (Under the direction of FLETCHER M. GREEN.)

From 1841 to 1861 a New England woman, Dorothea Lynde Dix, visited the jails, prisons, and almshouses in twenty states of the Union. She studied the condition of the insane confined in those places and memorialized state legislatures in their behalf. Largely through her influence existing hospitals were enlarged and improved, thirteen new state hospitals were established, laws were passed providing for the transfer of the insane from the jails and prisons to state hospitals, and reformed practices became established in the United States. She induced the Federal Government to establish a hospital for the insane of the District of Columbia and of the Army and Navy, but failed to procure federal aid for state hospitals. Miss Dix worked also in Canada and Europe, and after the Civil War followed up her earlier work in the United States. This thesis traces the general story of Miss Dix's work and treats in detail her work in the establishment of the State Hospital for the Insane in North Carolina.

GREVILDA CASSANDRA NORMAN. The Legislative History of the Act Abolishing Alien Contract-Labor. (Under the direction of WILLIAM WHATLEY PIERSON, JR.)

This thesis is a study of the attempt to abolish importation of alien contract-labor. It is divided into five parts. The first part traces the economic and social causes for the introduction of contract-labor into the United States. The second part concerns the opposition by organized labor. The third part narrates the legislative history of the contract-Labor Bill in the Congress and gives an analysis of the Act. The fourth part is an analysis of the amendments and of the final merging of all the Contract-Labor Laws into the general Immigration Act of 1917. The fifth part is an interpretative summary giving reasons for the failure of the Contract-Labor Laws.

REMBERT PATRICK. British Prisoners of War in the American Revolution. (Under the direction of R. D. W. CONNOR.)

This study of the royal forces captured by continental arms and imprisoned under continental supervision is treated in four essays on subjects relating to the control of prisoners. The first deals with the policy of control formulated by Congress and the agencies established to execute it. The second and third show the policy in practice as it relates to regular prisoners and the Convention Troops. The conclusion is reached that their treatment compared favorably with the standard set by rules of war. The last essay includes a treatment of the two cartels and exchanges made, the disputes which prevented other cartels, and the final release of prisoners in 1783.

EUGENE EDWIN PFAFF. The Committee of General Security: Its Genesis. (Under the direction of M. B. GARRETT.)

The Committee of General Security had precursors in both the Constituent and the Legislative Assemblies. The Committee of Inquiries of the Constituent Assembly attained powers similar to those of the Committee of General Security after the Flight to Varennes, June 20-21, 1791. The Committee of Surveillance of the Legislative Assembly was given such authority as a result

of the revolution of August 10, 1792. The Convention merely adopted the policy of preceding legislative assemblies in the creation of such a police committee. The unsettled state of affairs in France made such an institution a necessity during the years from 1789 to 1795.

PAULINE ROGERS. Qualifications for Suffrage and Eligibility in the Constitution of 1791. (Under the direction of M. B. GARRETT.)

The purpose of this investigation is to analyze the provisions for voting and holding office in France under the Constitution of 1791 with reference to liberality and civic reform.

An introductory survey of laws in England and the United States bearing on suffrage and eligibility provides a contemporary background and indicates the progress made in other countries toward civic liberty antecedent to the efforts of the French National Assembly to draw up a clearly-defined constitutional guarantee.

Abundant source material requiring careful interpretation is found in the actual debates of the National Assembly from May 5, 1789, to September 14, 1791, on the importance of land, personal property, tax-paying, residence, religion, education, age, nativity, servitude, the civic oath, and membership in the National Guard.

The result of the analysis is to throw new light on the civic reforms undertaken, on the subsequent complication of electoral machinery, and on the prompt demand for constitutional revision. The Constitution of 1791, although replaced soon by a more workable document, was a step in progress toward freedom through law.

DORIS LOUISE SCHNEIDER. Social Life in the First Continental Congress. (Under the direction of R. D. W. CONNOR.)

This study attempts to show that unanimity of sentiment in the First Continental Congress was caused by the social gatherings outside the formal sessions of the Congress which brought the fifty-six delegates together and gave them the opportunity to know one another as men rather than as representatives of three different sections. In the social life, in the informal gatherings at the various lodging houses or taverns, the visits to the homes of prominent Philadelphians, the dinners and breakfasts, the sight-seeing tours of the city, and the official entertainments, the men were given opportunity to exchange opinions, to voice various ideas, to debate and to discuss all questions to come before Congress, and to form judgments of the trustworthiness and ability of their fellow-workers. In this way it became possible for three sections with local interests, customs, ideas, and sentiment to work together in a common cause and to reconcile sectional differences.

JESSE CARL WILSON. Some Political Aspects of the Revolution in Georgia, 1763-1776. (Under the direction of FLETCHER M. GREEN.)

This paper attempts, first, to account for the slow growth of the revolutionary spirit in this province; second, to discover those points of friction

between the inhabitants of the colony and the home government as represented by royal officials, which tended either to accelerate or to retard the movement; and last, to describe the manner in which the royal government was eventually overthrown and a new state government set up in its place.

THE SCHOOL OF LAW

J. H. CHADBOURN has published during the year:

Lynching and the Law, 20 *American Bar Association Journal* 71-6, February, 1934.

FRANK W. HANFT has published during the year:

Control of Electric Rates in North Carolina, 12 *North Carolina Law Review* 289-325, June, 1934.

FREDERICK B. MCCALL has published during the year:

The Judicial System Becomes Complex—Our Judicial System Before and After 1919, *University News Letter,* Vol. XX, No. 5, February 28, 1934.

The following book reviews in 20 *American Bar Association Journal* 544-545:

More and Better Wills—Testamentary Benefactions. Edited by Alfred Williams Anthony.

Last Wills and Testaments, by Carl W. Mueller.

Wills, Executors, and Trustees, by William J. Grange.

E. M. PERKINS has published during the year:

Tax Injunctions and Suits to Recover Taxes Paid Under Protest in North Carolina, 12 *North Carolina Law Review* 20-42, December, 1933.

The Sales Tax and Transactions in Interstate Commerce, 12 *North Carolina Law Review* 99-119, February, 1934.

The Power of Congress to Levy Taxes for Distribution to States, 12 *North Carolina Law Review* 326-349, June, 1934.

M. T. VAN HECKE has published during the year:

A New Constitution for North Carolina, 12 *North Carolina Law Review* 193-212, April, 1934.

Review of Clark's Cases on Pleading and Procedure, Volume II, 47 *Harvard Law Review* 370-373, December, 1933.

R. H. WETTACH has published during the year:

Corporations as Agencies of the Recovery Program, 12 *North Carolina Law Review* 77-98, February, 1934. (In collaboration with R. H. SCHNELL.)

THE SCHOOL OF LAW has the following studies in progress:

M. S. BRECKENRIDGE and FRANK W. HANFT. Legal Problems in Group Insurance, a presentation and critical discussion of the law governing life insurance on groups of employees, to be published in *Law and Contemporary Problems.*

ALBERT COATES. Research on the Code of Criminal Procedure, to be published by the American Law Institute.

FREDERICK B. MCCALL. A study of *The Estate by Entireties and Some of Its Collateral Consequences.* (With assistance of W. R. BOOTH, Student Research Assistant.)

This research proposes to determine whether or not the common law marital estate by the entireties can any longer justify its existence on the basis of its social utility. Necessary remedial legislation will be suggested. To be published as an article.

A further study of *The Torrens System of Land Registration* to determine ways and means of bringing about a more widespread use of this highly desirable method of registering land titles. To appear in *Yale Law Journal.*

M. T. VAN HECKE. North Carolina Annotations for the Restatement of Contracts, to be published by the American Law Institute.

R. H. WETTACH. A Study (with the assistance of CHARLES S. MANGUM, JR.) to Determine the Legal Status of the Negro, with Particular Reference to the South.

Particular studies have been made concerning legal and practical aspects of the Negro in relation to serving on juries and voting. Further studies will involve problems of discrimination as illustrated by residential and other forms of segregation.

THE LIBRARY AND THE SCHOOL OF LIBRARY SCIENCE

ROBERT B. DOWNS has published:

(With LOUIS R. WILSON.) Special Collections for the Study of History and Literature in the Southeast. *Papers of the Bibliographical Society of America,* XXVIII, pt. 2, 1934.

The State Document Center Plan in North Carolina. American Library Association, *Public Documents,* 41-46. Chicago. 1934.

SUSAN GREY AKERS has had accepted for publication in an early issue of *The Library Quarterly*:

The Relation of the Professional and Clerical Division of Cataloging Activities to Cataloging Courses.

This article is based on Professor Akers' doctoral dissertation submitted to the faculty of the Graduate Library School of the University of Chicago.

DEPARTMENT OF MATHEMATICS

ARCHIBALD HENDERSON and JOHN W. LASLEY have published:

Mathematica Praetermissa. *Journal of the Elisha Mitchell Scientific Society,* L: 160-181. 1934.

PROFESSOR HENDERSON has delivered the following addresses:

New Theories of the Universe. Delivered before the Joint-Annual dinner of the American Mathematical Society and the Mathematical Association of America, Boston, Mass., December 28, 1933.

History and Achievements of the Elisha Mitchell Scientific Society. Delivered on the occasion of the Semi-Centennial celebration of the founding of the Elisha Mitchell Scientific Society. Chapel Hill, N. C., November 14, 1933.

JOHN W. LASLEY, JR., is making a study of the Differential Forms Associated with Conics.

This involves the applications of certain techniques of the theory of linear dependence and the theory of functional determinants to the differential equations of conics. Especial attention is being directed to Monge's differential equation with a view to obtaining a direct integration. Other associated forms and equations are being considered.

ERNEST L. MACKIE is directing the following research:

HUGHES B. HOYLE. (Progress on master's thesis.) On Conformal Mapping.

The following master's theses were accepted by the Department during the year:

FRANCES MARGARET JAMES. Determination of Asymptotes. (Under the direction of J. W. LASLEY.)

In "Determination of Asymptotes" various methods of obtaining both rectilinear and curvilinear asymptotes are given. The methods for rectilinear ones are divided according to those giving asymptotes parallel to the coördinate axes and those giving oblique asymptotes. The investigation for both rectilinear and curvilinear asymptotes is based on the definition that an asymptote to a curve is a line to which the curve approaches as we proceed from

origin further and further away, the ordinate difference of this line and that of the curve becoming infinitely small.

R. E. MARSHALL. Properties of Algebraic Equations all of Whose Roots are Real. (Under the direction of E. T. BROWNE.)

The purpose of this study is to collect and present proofs for the main properties of equations all of whose roots are real. Special emphasis is laid upon the conditions for real roots, necessary, or sufficient, or both.

The earlier theorems in the paper are based upon the work of Descartes, Sturm, Budan, and Fourier. The other theorems are due to Newton, Sylvester, Van Vleck, and Dunkel. The relations of some of these theorems—in some cases the practical equivalents of the theorems—are noted.

HOWARD MOVESS NAHIKIAN. Application of the Analytic Triangle to Higher Plane Curves. (Under the direction of J. W. LASLEY, JR.)

The purpose of this paper is to explain in some detail the properties of the analytic triangle which make it applicable to the analysis of higher plane curves. Fundamental theorems concerning the form of the infinite branches and those branches in the vicinity of the origin are proved for the general case, and are applied to numerical examples. A method of obtaining by the triangle the second approximations of these branches is also explained. The analytic triangle is shown to be applicable to the separation of the branches of a curve at a multiple point. Finally, a generalized form of the analytic triangle is given, and is shown to be useful in the analysis of the projective properties of a curve.

BILLY JAMES PETTIS. An Introduction to Periodic Decimal Fractions and Their Properties. (Under the direction of E. T. BROWNE.)

The decimal form of any given fraction is either non-periodic, i.e., terminated by ciphers, or periodic (simple or compound). Necessary and sufficient conditions are established for each of these types. Two methods are then given for finding the number of digits in the period of any given fraction. Next considered is the converse of this last problem, viz., given any integer n, to find one or more fractions whose periods will be of length n. The discussion, giving two methods of solution, is based on proper and primitive divisors of 10^n-1, and includes the theorem: for any integer n there exists a prime p with respect to which 10 belongs to the exponent n. Hence for increasing values of n the factorization of every 10^n-1 introduces a new prime. The thesis is concluded with a short discussion of a few well-known properties of repetends (periods), a note on divisibility, and a short history.

JOHN POTTER TORIAN. A Problem in Inversion. (Under the direction of A. S. WINSOR.)

This thesis consists of a solution, by application of the principle of inversion, of the Apollonian Problem, namely, that of describing a circle tangent to three given circles. Certain properties of radical axes and centers, coaxal circles and centers of similitude are employed in addition to those of inversion.

These terms are defined, and on the basis of their definitions are proved six theorems which are essential to the solution of the problem. Following the solution of the general problem is a treatment of its special cases, the most important of which is that of describing a circle tangent to three given circles, all of which pass through the same point.

GUY AYTCH YORK. Various Methods of Determining the Upper Limits of the Real Roots of Algebraic Equations. (Under the direction of E. T. BROWNE.)

In this paper are given eighteen methods for determing an upper limit to the real roots of an algebraic equation $f(x)=0$. Not all of the methods, however, are based on distinct principles, some being slight variations from others.

Among the outstanding methods are (1) those based on the largest negative coefficient of $f(x)$, (2) those based on auxiliary polynomials determined by synthetic division, (3) those based on the function and its derivatives, (4) those based on the rearrangement of terms in $f(x)$, (5) those based on transformed equations.

There is no one method that will work best for all equations. One method may work best for one equation while another works much better for another equation. The nature of the equation will suggest which method to use. Method VIII in this paper gives the best result for most equations.

THE MUSEUM OF NATURAL HISTORY

J. M. VALENTINE has published:

Technique in the Preparation of *Coleoptera. Journal of the Elisha Mitchell Scientific Society.* L: 255. 1934.

Original methods in the art of mounting insect specimens are presented in the hope of obviating some of the inadequacies encountered in the study of the average entomological collection.

MR. VALENTINE has completed two philosophical essays for publication:

Fundamentalism versus Agnosticism in Science.

Sympathetic Evolution.

Both are critical commentaries upon the mechanistic approach in the biological sciences. The latter paper is based upon field studies, abroad and at home, of carabid and cicindelid beetles.

He is continuing research on the application of theories of evolution to the above forms and is engaged in taxonomic investigations of local carabid faunas.

DEPARTMENT OF PHARMACOLOGY

WM. DEB. MACNIDER has published during the year:

The Acute Degenerative Changes and the Changes of Recuperation Occurring in the Liver From the Use of Ethyl Alcohol. A Functional and Pathological Study. *Journal of Pharmacology and Experimental Therapeutics,* 49: 1: 100. 1933.

Pathological Changes in the Dog Kidney Resembling the Normal Histological Structure Occurring in the Aglomerular Fish Kidney, Opsanus Tau. *Proceedings* of the Society for Experimental Biology and Medicine, 31: 293. 1933.

The Influence of Liver Degeneration and Recuperation on the Acid Base Equilibrium of the Blood. *The Journal of Pharmacology and Experimental Therapeutics,* 50: 1: 108. 1934.

SCHOOL OF PHARMACY

H. M. BURLAGE has completed the following studies during the year:

Study of Swelling Factors of Various Species of Psyllium.

Methods have been subjected to an individual and a collaborative study with the possibility of inclusion in Methods of Association of Official Agricultural Chemists.

Assay of the Official Sulphur Ointments.

A method has been proposed for the determination of sulphur in the official ointments with encouraging results.

The Effect of Antoxidants on the Preservation of Lard and Suet.

Further Studies on Aromatic Elixir.

PROFESSOR BURLAGE has been engaged in the following studies during the year:

A Survey of Drugs and the Drug Industry of North Carolina. (With M. L. JACOBS.)

The Constituents of White Snake Root.

Phyto-chemical studies of *Eremocarpus setigera.*

The Examination of the Volatile Oil of *Heracleum lanatum.*

Chrysopsis graminifolia, its Composition and Preparation.

M. L. JACOBS has completed:

A Survey of Drugs and the Drug Industry in North Carolina. (With H. M. BURLAGE.) A Study of Some New Solvents in Alkaloidal Assaying.

DEPARTMENT OF PHYSICS

ARTHUR E. RUARK published the following research while on the faculty of the University of Pittsburgh:

Atomic Weights of Radioactive Substances. *Journal of Chemical Physics,* 1: 717. 1933. (With FOREST WESTERN.)

The Half Life of Actinouranium and the Problem of Geologic Time. *Physical Review,* 44: 675. 1933. (With FOREST WESTERN.)

The Radium-Uranium Ratio and the Number of Actinouranium Isotopes. *Physical Review,* 45: 69. 1934. (With FOREST WESTERN.)

The Half Life of Actinouranium. *Physical Review,* 45: 628. 1934. (With FOREST WESTERN.)

X-Ray Wave Lengths from Crystals and Ruled Gratings. *Physical Review,* 45: 827. 1934.

PROFESSOR RUARK has had accepted for publication:

X-Ray Terms of Radioactive Elements, with Applications to Beta and Gamma Ray Spectra. *Physical Review.* (With FREDERICK A. MAXFIELD.)

He has completed, but has not published, the following research:

Inspectional Analysis: A Method to Supplement Dimensional Analysis.

Under the direction of PROFESSOR RUARK, ROBERT B. HULL of the University of Pittsburgh completed a thesis for the master's degree, entitled:

Crystal Structure of Nickelous Acetate Tetrahydrate.

Abstract presented at Berkeley, California, meeting of the American Physical Society, June, 1934.

PROFESSOR RUARK and his colleagues have the following research in progress:

An Empirical Study of the Geiger-Nuttall Law for Alpha Particles.

Survey of Gamma Ray Spectra and Nuclear Energy Levels.

Gamma Ray Spectra of Substances in the Radium Series.

The Time Distribution of Radioactive and Cosmic Ray Events Recorded by Geiger Counters. (With LEE DEVOL and FOREST WESTERN.)

A Search for Artificial Radioactivity Produced by Cosmic Rays, Gamma Rays, and Beta Rays. (DEVOL, WESTERN, and RUARK worked on this in the summer of 1934. The work is being continued by WM. L. SMITH, KARL H. FUSSLER, and ARTHUR E. RUARK.)

OTTO STUHLMAN, JR., published the following articles:

The High Frequency Magnetic Field of a Flat Spiral Coil. *Review of Scientific Instruments,* IV: 532. 1933. (With SHERWOOD GITHENS, JR.)

For abstract see *Research in Progress,* 1933, p. 63.

Intensity of the Hydrogen Alpha and Beta Lines as determined by the Frequency of the Electrical Field in Electrodeless Discharge. Read, American Physical Society Meeting, April, 1933. To appear (with M. S. MCCAY) in *The Journal of the Franklin Institute.*

Hydrogen was excited at constant pressure to emit the glow discharge by means of a h. f. electrical field associated with a solenoid excited at low current density. Frequency range 5.0 to 7.5 mega-cycles. A dynamically balanced push-pull oscillator was driven at power range 10 to 100 watts. Pressures were constant. Values near 250 microns were used. The intensity of the general radiation was measured with a photo-electric cell. Intensities of the alpha and beta lines were obtained photographically using intensity markers, with experimental errors of 5 per cent. Results show that, with constant power input, the intensities of these spectral lines per unit field strength are directly proportional to the frequency of the oscillating electrical field.

Intensity of the Hydrogen Spectrum as Determined by the Frequency of the Electric Field in Electrodeless Discharge. Read (with MYRON S. MCCAY) North Carolina Academy of Science Meeting, May 4, 1934.

For abstract see *Journal of the Elisha Mitchell Society,* 50: 55. 1934.

Selective Radio Frequency Absorption of Iodine Vapor. Read (with W. L. SMITH) North Carolina Academy of Science Meeting, May 4, 1934.

PROFESSOR STUHLMAN has the following studies under way:

The Intensity of Spectra, as influenced by External Conditions of Excitation, in the Electrodeless Discharge.

Electrodeless Discharges in Gases as conditioned by Frequency and Potential. (With SHERWOOD GITHENS, JR.)

Spectroscopic Quantitative Analysis of Metals in Plant Ashes. (With KATHARINE WAY.)

E. K. PLYLER has continued studies upon infrared absorption spectra of liquids and solids. In particular the work this year has been concentrated upon the infrared absorption bands in solutions.

PROFESSOR PLYLER and his students have completed and published the following researches:

The Infrared Absorption of Water from 2.5 μ to 6.5 μ. (With C. J. CRAVEN.) *Journal of Chemical Physics,* 2: 303. 1934.

A study has been made of the infrared absorption bands of water from 2.5 μ to 6.5 μ and new bands have been found at 3.30 μ, 5.56 μ. The band at 4.7 μ showed an irregular envelope and may contain several components. The change in position of the maximum in the 3 μ region with thickness is explained as due to difference in sharpness of the components which constitute the band. The band at 6.15 μ did not show the corresponding shift with thickness.

The Infrared Absorption of Solutions of Hydroxides and Hydrolyzing Salts. (With WALTER GORDY.) *Journal of Chemical Physics,* 2: 470. 1934.

Absorption bands have been found at 3.6 μ and 5.2 μ in aqueous solutions of NaOH, KOH and LiOH. Solutions of $ZnCl_2$, $ZnBr_2$, $NH_4C_2H_3O_2$, Na_2CO_3, $NaC_2H_3O_2$, $Na_2B_4O_7$, Na_2SiO_3 and $Al_2(SO_4)_3$ were studied in the region from 2.8 μ to 6 μ and bands were observed at about 3.45 μ, 4.5 μ, 5.2 μ and 5.6 μ. The solutions which are acid in reaction had intense bands at 3.6 μ and 5.2 μ, while the basic solutions gave a strong band at 5.6 μ. This variation in intensity indicates that the absorption bands are due to undissociated molecules bound to water molecules. The band at 4.5 μ is probably due to water which has been modified by the ions. The hydroxides showed the absorption bands at 3.6 μ and 5.2 μ when 0.1 N solution was used.

The Infrared Absorption of Acid Solutions. (With E. S. BARR.) *Journal of Chemical Physics,* 2: 306. 1934.

A study has been made of the absorption of aqueous solutions of HCl, HF, HBr, H_2SO_4, HNO_3, NaCl and NaBr in the region from 1.7 μ to 6.5 μ. Also HCOOH, C_6H_5COOH have been studied from 5 μ to 6.5 μ. No absorption bands were found for HCl and HBr in the regions of 3.5 μ and 3.8 μ, respectively, where there are strong bands in the gaseous state. All of the acid solutions showed a strong band at about 5.5 μ. The position of this band varied slightly with the solute and the sharpness of the band was different for each acid. Another band was found at 2.40 μ for the solutes. The 5.5 μ band is explained as due to the undissociated molecule attached to a water molecule and the 2.40 μ band as due to the same effect or to a hydrogen ion attached to a water molecule.

The Infrared Absorption of Alcoholic Solutions of Hydroxides. (With F. D. WILLIAMS.) *Journal of Chemical Physics,* 2: 565. 1934.

For abstract see also master's thesis of F. D. WILLIAMS.

Bands have been observed at 0.7 μ, 0.95 μ, 1.05 μ, 1.27 μ, 1.30 μ, 1.73 μ, 1.89 μ, 2.30 μ, 2.60 μ, 3.80 μ and 5.20 μ in alcoholic solutions of hydroxides. Solutions of NaOH and KOH gave the same positions for the bands. It was found that if the bands at 3.80 μ and 5.20 μ were considered as fundamentals, the remaining bands could be classified as harmonics. The similarity of the

observed bands of the alcoholic solutions to the bands of aqueous solutions is mentioned.

The Infrared Bands and Molecular Constants of HBr. (With E. F. BARKER, University of Michigan.) *Physical Review,* 44: 986. 1933.

The fundamental band of HBr has been remeasured, and the harmonic band examined for the first time under high resolution. From the equations representing line positions the values ν_0=2649.74 cm^{-1}, I_0=3.2634 x 10^{-40} g cm^2, and r_0=1.4096 x 10^{-8}cm are obtained. Resolution of the isotopic components was just possible in the fundamental band, and the observed separation agrees with those computed from the isotopic masses of Br.

PROFESSOR PLYLER and his students are at present continuing the study of solutions in reference to organic compounds.

MR. WALTER GORDY has continued research in infrared absorption of solutions of hydroxides and hydrolyzing salts and has published the following article:

Near Infrared Absorption of Solutions of Hydroxides and Hydrolyzing Salts. *Journal of Chemical Physics,* 2: 621. 1934.

Absorption bands have been observed at 2.60 μ, 2.30 μ, 1.81 μ, 1.30 μ, 1.22 μ, 1.04 μ, 0.87 μ, 0.75 μ and 0.67 μ in aqueous solutions of hydroxides and hydrolyzing salts. From the behavior of the salt salutions the bands at 2.60 μ and 1.81 μ were found to be characteristic of the hydroxide molecule, while the band at 2.30 μ was found to be characteristic of the OH ion. It was found that if the 2.30 μ band, and the 3.65 μ and 5.20 μ bands previously observed were considered as fundamentals, the remaining bands observed could be classified as harmonics.

The following master's theses were accepted by the Department during the year:

ANTONIOS ANTONAKOS. Infrared Absorption of Aqueous Solutions of Various Halides. (Under the direction of E. K. PLYLER.)

The investigation was concerned with the effect of readily soluble salts on the infrared spectrum of water in the region 4 to 5 microns. A group of halides was used and it was found that $ZnCl_2$ and $ZnBr_2$ have a marked effect on the position and intensity of bands in this region.

WALTER GORDY. The Effect of an Electric Field on the Infrared Asorption of Molecules. (Under the direction of E. K. PLYLER.)

An attempt was made to change temporarily non-polar molecules into the class of polar molecules, and hence, to produce infrared absorption by molecules which ordinarily do not absorb infrared radiation. A careful study was made of molecular hydrogen in the region from 0.9 μ to 2.0 μ. A field strength of approximately 30,000 volts was used with two atmospheres of hydrogen

and an absorption cell of 100 centimeters in length. No measurable induced absorption was observed in the region studied.

C. MERRITT LEAR. Electrification by Collision of Mercury Vapor with an Iron Collector. (Under the direction of OTTO STUHLMAN, JR.)

A recent communication by E. Perucca showed that apparently a new form of electrification was established when an iron collector was bombarded with a stream of mercury vapor. The theory proposed was that the electrification was produced by frictional contact of the mercury vapor against the surface of the collector. The object of this new investigation was to either verify or disprove Perucca's theory. While the apparatus used in this experiment was very much the same as Perucca's, the observations lead to a new theory; the charge on the collector is not due to friction between the mercury vapor and the iron collector but is due to the friction between the collision of the mercury vapor and the gas film on the solid body—the collector in this case.

MYRON STANLEY MCCAY. The Intensity of the Alpha and Beta Lines of Hydrogen as Conditioned by Pressure and Tube Diameter when Excited by Electrodeless Discharge. (Under the direction of OTTO STUHLMAN, JR.)

The intensities of the hydrogen alpha and beta lines as excited by high frequency, undamped voltages were studied as conditioned by pressure of the gas and diameter of discharge tube. The values of the intensities of each line were found to pass through definite maxima between pressures of 30-200 microns of mercury, in a similar manner to the change of conductivity in the discharge. The pressures of these maxima were shifted to higher values by decreasing the diameter of the discharge tube. An explanation of the determined effect of tube dimensions on these maxima has been developed.

FRANCIS DUDLEY WILLIAMS. Infrared Absorption of Alcoholic Solutions of the Hydroxides of the Alkali Metals. (Under the direction of E. K. PLYLER.)

This investigation was concerned with the absorption spectra of alcoholic solutions of hydroxides. The spectra of solutions of this type were found to consist of the absorption of the alcoholic solvents with additional bands superimposed owing to the presence of the solute. The region studied was from .8 μ to 7 μ. Intense bands due to the presence of the hydroxide were found at 3.8 μ and at 5.2 μ. A hitherto unobserved alcohol band was discovered at 6.2 μ. Other absorption bands due to the hydroxide present were found at 2.6 μ, 2.3 μ, 1.89 μ, 1.73 μ, 1.30 μ, 1.27 μ, 1.05 μ, .95 μ, and at .76 μ. These bands may be classified as harmonics of the fundamentals at 3.8 μ and at 5.2 μ. The band as 2.3 μ may be a combination. The bands listed above seem to be characteristic of all hydroxides and apparently do not experience shifts of position with any particular one studied. These bands are probably due to some type of linkage between the hydroxide molecules and the molecules of the solvent.

DEPARTMENT OF PHYSIOLOGY

E. V. McCHESNEY has submitted for publication:

A Simple Method for the Determination of Malic Acid.

The Determination of Alanine in Biological Materials.

The Determination of Lactic Acid in the Presence of Certain Interfering Substances.

PROFESSOR McCHESNEY has completed (assisting DR. B. W. McKENZIE of Salisbury) a study of the blood serum proteins in essential epilepsy.

He is continuing work along the general line of the analysis of proteins, including the following projects:

An attempt to repeat Dakin's isolation of beta-hydroxyglutamic acid from casein.

An analysis of the dicarboxylic acid fraction of the protein silk fibroin.

DEPARTMENT OF PSYCHOLOGY

The following master's theses were completed under the direction of the Department during the year:

ANNE LESLIE CHADBOURN. Studies in Testimony. (Under the direction of J. F. DASHIELL.)

Problem: To determine the relative values of reports or judgments regarding an original event in question as furnished by *witness,* by *individual juror,* and by *jury group.*

Procedure: The original event was standardized in the form of a somewhat dramatic motion picture. This was exhibited to four witnesses. Then, one by one, these witnesses gave their testimony concerning the event before a group of fifteen jurymen, stenographic notes being taken. Each juryman then wrote out his individual report of the event, based on this composite testimony. Finally, the jurymen were grouped into juries of five men each; and, after discussion, a final judgment was written out by each jury-as-a-group. This whole procedure was repeated for a total of eight experiments, involving four groups of subjects.

Results: 1. In free narration, the individual jurymen were about as complete and as accurate as were the original witnesses; but in answering cross-questions the former were clearly inferior in both respects. The completeness of the jurymen's accounts depended upon the variety of details in the witnesses' accounts, but the accuracy of the former's accounts was not so directly dependent.

2. The juries-as-wholes, following their discussions, clearly surpassed the individual jurors before discussion, in both completeness and accuracy.

3. The consistency of the trends of results in the eight different experimental groups gave strong indication of the feasibility of quantitative research in this field.

MARY FLEMING PORTER. Psychasthenic Mechanisms. (Under the direction of ENGLISH BAGBY.)

Some of the mechanisms of psychasthenia are presented in the backgrounds and reactions of a specific malfunctioning neurotic individual. The handicaps of a "predisposition" (Janet) to organic weakness and of illness and anxiety in the home environment are weighed as to their influence on the maladjusted behavior. The obsessions, doubts, compulsions, phobias, etc., constituting the particular "reaction-type" (Meyer) are weighed in the light of the theories of Janet, Freud, and Adler, each of whom offers a partial explanation. An interpretation along more comprehensive lines, including the workable truths in all, but positing a less exclusive motivation and stressing the importance of neglected but vital causal and contributing factors, is offered.

The following doctoral dissertation was accepted by the Department during the year:

RUTH HAMILL PRESTON. The Retracing Factor in Reversed Maze Learning by the White Rat. (Under the direction of J. F. DASHIELL.)

White rats were trained in a 6-unit maze: in one direction the maze consisted of T-choices; in the reversed direction it consisted of L-choices. The turn-sequence was identical for both directions. Two groups of rats learned the maze as T-choices and two groups learned it as L-choices. Then the groups learned the maze in the reversed direction. Retracing was unrestricted throughout the learning. The following conclusions are indicated:

1. Without previous maze training, the white rat's learning of the maze as L-choices or as T-choices was neither facilitated nor inhibited by the number of retracings nor the distance covered on retracings (either total distance reversed or distance reversed on the true path).

2. With previous maze training consisting of mastery of the maze as L- or as T-choices, the reversed learning of the maze as T- or as L-choices, respectively, was neither facilitated nor inhibited by the number of retracings nor the distance retraced on the true path during original forward learning.

3. Trials for mastery of the forward and of the reversed learning correlated negatively when the transfer was from T- to L-choices and from L- to T-choices.

4. The 6-unit maze as T-choices was more difficult than as L-choices under two conditions: (1) without previous maze experience, and (2) when previous maze experience consisted of mastery of the maze as L-choices.

5. Performances on revised learning indicated very little saving in number of trials for mastery over the number of trials required by rats without any previous maze training.

The data are interpreted as indicating that retracing during the forward learning is not the only factor operating during the reversed learning. Instead,

the *type of behavior* required for the types of turns involved in the forward and in the reversed learning and the *intensity of the direction orientation* established during the forward learning are indicated as more important factors operating in the reversed maze learning by the white rat.

THE SCHOOL OF PUBLIC ADMINISTRATION

The following studies were completed in the Department during the year:

The History of North Carolina by A. M. ARNETT and W. C. JACKSON. Chapel Hill: University of North Carolina Press. 1933.

This is a school history of the State of North Carolina, designed for the sixth and seventh grades of the grammar schools. It is characterized especially by an emphasis upon the social and economic development of the State. The actual writing of the book was done by A. M. Arnett, but W. C. Jackson conferred at all points not only in the actual writing but is jointly responsible for the point of view and the historical facts presented. The work, of course, covered a period of years but was completed within the past year.

The Personnel of Southern Legislatures by W. C. JACKSON.

This brief study based on manuals, yearbooks, handbooks, and personal correspondence and questionnaires, is a picture of the Legislatures of eleven Southern States. The information includes age, occupation, party affiliation, religious and fraternal orders, former experience as legislator or office-holder, etc. The study is a partial one, inasmuch as complete information could not be secured from all sources. The most important information obtained relates to occupations and party affiliations.

Cities in Depression by C. F. LEWIS.

This was a compartive study of the cities of Asheville, Greensboro, and Rocky Mount, with particular reference to the financial transactions of these cities during the past five years. There was an examination of the form of government in each city and discussion of its relationship to taxation, public improvements, and finances of all kinds.

A Survey by COLUMBUS ANDREWS of seventeen counties in Western North Carolina which are included in the TVA project.

WILEY B. SANDERS directed the Rosenwald study of *Negro Child Welfare in North Carolina,* published by the University of North Carolina Press, July, 1933.[1]

In order to bring up to date the statistical analysis of juvenile court records in North Carolina, 1919-1929, as presented in the above publication, PROFESSOR SANDERS is making a similar analysis of juvenile court records for the depression period, 1929-1934.

1. For a description of these studies, see *Research in Progress,* 1932-1933, p. 77.

PROFESSOR SANDERS has also collaborated with GEORGE H. LAWRENCE in further work on a book to be entitled Rural Social Case Record.[1]

The following master's theses were completed during the year under the supervision of the Department:

CHARLOTTE CALIFF. Wage Differentials Between Negro and White Workers in Southern Industry. (Under the direction of H. D. WOLF.)

Beginning with a short historical summary and a discussion of wage differentials and related forms of racial discrimination, this thesis discusses the present status of the Negro worker under the NRA, the Codes of Fair Competition as they affect him, and attempts an evaluation of various factors which may hinder or aid the improvement of his economic condition.

RUTH BRUNER HENRY. A Study of Emergency Relief of the Unemployed in Orange County, N. C., October 1, 1932-March 31, 1933. (Under the direction of W. B. SANDERS.)

This study includes information concerning the situation previous to the time when Federal aid became necessary, a descriptive background of the county relative to the subject, a brief explanation of national, state, county, and local plans of relief, information concerning those aided, kind and amount of aid administered and the general results of unemployment in the county.

The information was obtained from duplicate case cards of applicants which are on file at the Central Welfare Office of the county situated in Chapel Hill, N. C., reports of the County Superintendent of Public Welfare, records of the County auditor, interviews and visits.

Following a brief explanation of national, state, county, and local plans of administration and organization of emergency relief, the study is concerned with the situation as it is in Orange County. The seven townships of the county were studied individually. The information was collected by township and race to determine what sections of the county and what classes and races were most in need. The social information concerning the applicants as to race, township, sex, age, previous occupation, marital condition, dependents, and special resources and liabilities is summarized.

DEPARTMENT OF ROMANCE LANGUAGES

STURGIS E. LEAVITT has published:

A Tentative Bibliography of Colombian Literature. Cambridge: Harvard University Press. 1934. (In collaboration with CARLOS GARCÍA-PRADA, of the University of Washington.)

He is working on a bibliography of Hispano-American Literature in the United States, 1932-1934; a bibliography of biography and

[1] Cf. *Research in Progress.* 1932-1933, p. 77.

literary criticism in Hispanic America; a study of the *comedia de figurón* in Spain; the *tradición* in Spanish America.

PROFESSOR LEAVITT is directing the following research:

F. C. HAYES. (Progress on doctoral dissertation.) Proverb Lore in the Drama of *Siglo de Oro.*

J. V. MCCALL. (Progress on doctoral dissertation.) The Dramatic Works of Luis Mariano de Larra.

W. A. MCKNIGHT. (Progress on master's thesis.) Antonio Hurtado y Valhondo.

W. P. SMITH. (Progress on doctoral dissertation.) Jesús Castellanos and his Works.

U. T. HOLMES has published the following:

Mediaeval Gem Stones, *Speculum,* IX (April): 195-204. 1934.

French Words of Chinese Origin, *Language,* X (September): 280-285. 1934.

The Waldensian Dialects in North Carolina. *Zeitschrift für romanische Philologie,* LIV: 500-513. 1934.

He has the following in press:

The Works of Guillaume du Bartas, Vol. I, to be released by the University of North Carolina Press in December, 1934.

PROFESSOR HOLMES read the following paper before the Medieval French section of the Modern Language Association at its meeting in Saint Louis on December 28, 1933:

The *Chétifs*: an Old French Crusade Epic.

A paper was also read before the General Renaissance section at the same meeting:

The Philosophic Ideas of Guillaume du Bartas.

PROFESSOR HOLMES has continued his field work on the dialects in Valdese, N. C. He has also in preparation a paper on the fauna in the *Typographia Hibernica* of Giraldus Cambrensis (12th century). His studies in the non-Latin elements in the Romance languages are also being continued.

The following doctoral dissertations are in progress under his direction:

D. E. FRIERSON. The Franco-Venetian Dialect of the *Chansons de Geste.*

W. D. CREECH. The French versions of the medical writings of Trotula.

G. R. SULKIN. An edition of two Old French *lais.*

IDA PATRICK. A Critical Study of Benoist's *Estorie des Dus de Normandie.*

L. B. STABLER. Studies in Middle French Syntax.

N. B. ADAMS is continuing his studies in the Spanish drama of the Romantic period. He is preparing a paper on the Siglo de Oro plays in Madrid, 1820-1850, before the Modern Language Association.

H. R. HUSE has published:

The Illiteracy of the Literate: A Guide to the Art of Intelligent Reading. New York: Appleton-Century Co. 1933.

He is working at present on the social criticism of Anatole France.

J. C. LYONS has published:

Literary Evidence of the Prestige of the Black Arts in Sixteenth-century France. *Studies in Philology,* April, 1934.

The article was presented before the Comparative Literature of the Renaissance group at the annual meeting of the Modern Language Association in Saint Louis.

The paper was also read before the Philological Club February 7, 1934.

For abstract, see p. 110.

PROFESSOR LYONS is continuing work on the three volumes of the *Life and Works of Salluste du Bartas,* which is being done in collaboration with U. T. HOLMES and R. W. LINKER. Volume I is now in press and Volume II is approximately ready for printing.

RALPH S. BOGGS has published:

A review and notes on the American section of Johannes Bolte's bibliography (vol. 5) of his *Anmerkungen zu den Kinder- u. Hausmärchen der Brüder Grimm* (1932). *Journal of American Folklore,* XLVI: 97-100. 1933.

As American collaborator, PROFESSOR BOGGS has continued to compile the American items for the *Volkskundliche Bibliographie,* published in Berlin. During 1933 the volumes for 1927 and 1928 appeared.

He has completed a comparative study of the Spanish proverb *Quien no te conoce, te compre,* to appear in *Studies in Philology.*

He continues a study of folklore in the *Celestina.*

As chairman of the Folklore Group in the Modern Language Association of America, PROFESSOR BOGGS has this year initiated a project, conceived by this Group, for the gathering and study of American folklore, a plan somewhat similar to that of the American Linguistic Atlas. A national committee is already at work on the plan.

Student help, available through the Federal Relief Fund, and materials, available through the Smith Fund, make possible the compiling of an Historical Dictionary of Spanish proverbs. This project has been initiated under the direction of FRANCIS C. HAYES, whose continued work on his doctoral dissertation, involving proverbs in the Golden Age drama, especially fits him for this work.

JAMES Y. CAUSEY has begun, as his doctoral dissertation, the preparation of an edition of the *Poema de Alfonso Onceno,* under the direction of R. S. BOGGS.

ROBERT W. LINKER has continued work on an edition of *The Works of Guillaume de Salluste, Sieur du Bartas.* (With U. T. HOLMES, JR.)

He is editing the *Tezaur* of Peire de Corbiac and the *Works of François Villon,* with English vocabulary and notes.

The following master's theses were accepted by the Department during the year:

GEORGE COTTON SMITH ADAMS. Malherbe's Principles of Rhyme and Grammar Applied to the Poetry of Jean Bertaut. (Under the direction of J. C. LYONS.)

François de Malherbe (c. 1555-1628), native of Caen in Normandy, dogmatic and vigorous author and critic, tried to reform the French language by excluding archaic words, neologisms, coined words, words borrowed from foreign sources, technical words, latinisms, patois words. His ideas for reform of style, usage, expression, grammar, and poetic language are found in a copy of the poetry of Philippe Desportes, whose work he annotated with marginal comments, ably interpreted by Ferdinand Brunot in his "Le Doctrine de Malherbe d'après son Commentaire sur Des-Portes," Paris (1891). Jean Bertaut (1552-1611), reserved poet, also a native of Caen, admired and tried to imitate both Ronsard and Desportes. His poetical works have been examined and corrected according to eight of Malherbe's grammatical rules and four of his rules for rhyme. The results show 3,396 cases of adherence to Malherbe's rules and 625 cases in which the rules were broken, thus indicating that to a large extent Malherbe's principles were already in effect and were being used by a poet who wrote before the time when Malherbe gave himself credit for innovating them, and thereby demonstrating wherein these rules must have been natural tendencies.

STANLEY THOMAS BALLENGER. The Legend of the Horse of Don Sancho in Spanish Literature. (Under the direction of N. B. ADAMS.)

The legend of Don Sancho's horse appears first in the *Crónica General* and furnishes a theme for supposedly serious historians and for literary elaboration down through the Romantic period. Lope de Vega's *El testimonio vengado* is the first play on the subject. It is characterized, as one would expect, by skillful development of plot and delicacy in character drawing. Moreto's *Como se vengan los nobles* is almost a *refundición* of his predecessor's work, with a few additions and omissions. The action is more compact. The next important play upon the theme is Zorilla's *El caballo del rey don Sancho,* which leans more heavily upon legendary material than upon preceding dramas, and is in a large measure the product of Zorilla's melodramatic imagination. García Gutiérrez's *El bastardo* is the feeblest offspring of the legend. The popularity of the story of Don Sancho's horse furnishes an excellent example of the vitality and continuity of legendary lore in Spain.

DÉLFIDO CÓRDOVA. Some Aspects of the Dramatic Art of Narciso Serra. (Under the direction of S. E. LEAVITT.)

Less than a hundred pages of critical material have been written about the nineteenth century dramatic poet Narciso Serra, and no detailed analyses of his dramatic works have been made. This thesis analyzes thirty-nine of his fifty-two known works and classifies them as dramas based on the Spanish stage, romantic dramas, dramas of local color, zarzuelas, dramas from foreign sources, and dramas written in collaboration with other Spanish playwriters.

Serra's works are noted for their lyricism, for poor plot development, and the influence of the contemporary stage upon them. Best developed are his women characters. His royal characters are portrayed unsympathetically. He is at his best in works of local color and especially in his zarzuelas, in which he surpasses most of his contemporaries. He was one of the most popular dramatists with the common folk in the third quarter of the century.

CAMILLUS JACKSON DISMUKES. The Influence of Friedrich Nietzsche and Arthur Schopenhauer on Pío Baroja. (Under the direction of S. A. STOUDEMIRE.)

This thesis is an attempt to classify and analyze Pío Baroja's ideas and to point out certain similarities to be found in Nietzsche and Schopenhauer.

Baroja is treated as a philosopher and as an anarchist. He is a pragmatist, a dualist, and a pessimist who regards mind and change as ultimate realities, and who manifests as three phases of his pessimism Nihilism, Stoicism, and scorn of life. In his religious, social, and political Anarchism he attacks Christianity, morality, money, whiskey, monogamous marriage, education, democracy, and the existing penal system. Rejecting the possibility of solving the problems of collective humanity, he centers his constructive theories in the egoistic individual who, as represented in the character of César Moncada, is a replica of the Nietzschean Superman. Baroja's cosmological and ontological views coincide with Schopenhauer's and his anarchistic and con-

structive theories have numerous analogies in Nietzsche's doctrine. The sum total of similarities is indicative of the influence of the German philosophers on the Spanish novelist.

ANNIE BEAM FUNDERBURK. The Character of Esther in French Dramatic Literature from 1450-1689. (Under the direction of J. C. LYONS.)

The variations of the nine treatments of the Esther story from 1450-1689 are drawn from three sources, the Bible, Apocrypha, and Josephus.

In the *Mistère du Viel Testament* c.1450, Esther is the personification of the Virgin Mary; in *Aman* (1561) of Rivaudeau, Esther is a Diplomat; in *Esther* (1585) of Matthieu, Esther is a medieval Joan of Arc; in *Aman* (1601) of Montchrestien, Esther is a zealous Patriot; in *La Belle Hester* (1612) of Marfrière, Esther is the epitome of Beauty; in the anonymous *Tragédie Nouvelle de la Perfidie d'Aman* (1622), Esther is a wily Flatterer; in the *Esther* of Du Ryer (1642), Esther is a Queen of Clemency; in the *Esther* (1673) of Desmarets de Saint Sorlin, Esther is a paragon of Wisdom; in *Esther* (1689) of Racine, Esther is the personification of Piety. The conclusions are: the characterization is different in each work; each succeeding writer draws materials from the three sources rather than from preceding works; each presentation of the character of Esther is more or less appropriate for its own age.

LUCY ESTES GRIMSLEY. *Le Chevalier au Cygne et Godefroi de Bouillon.* (Under the direction of URBAN T. HOLMES.)

This study attempts to discuss the legendary poems of the Cycle of the Crusades with the special purpose in view of clarifying some of the theories about the origins of the Swan-Knight legend and the myth of the Swan-Children. It shows how these poems grew from an historical background into a cycle of songs to which were added many folk and mythological elements. The two legends are traced to Celtic origin, and the method by which they were attached to Godfrey of Bouillon is discussed and traced.

The extant manuscripts of these poems are classified and traced to the original ones, and the best known versions have been analyzed, described, and compared. The following tentative conclusions were drawn: (1) That the nucleus of these poems existed in oral tradition long before they were written; (2) that there were manuscripts, at least one, before the extant manuscript of the twelfth century; (3) that of the nine extant French manuscripts there are probably three which derive from a lost original, the remainder being translations of these three or translations made from copies of them.

HERMAN RASCOE MADDOX. Paul Meyer's Notices of Unpublished French Manuscripts: an Analysis. (Under the direction of URBAN T. HOLMES.)

Beginning in 1872 Paul Meyer published notices and extracts of one hundred fifty-one manuscripts in Old and Middle French found in various li-

braries of Europe. These notices were published in the *Romania, Bulletin* de la Société des Anciens Textes Français, and *Notices et Extraits des Manuscrits.* These notices are important because they constitute our only source of knowledge of most of the manuscripts which have not been studied in detail or published. All the manuscripts are listed and their contents analyzed in the thesis. There is a classified list of their contents with references to the individual manuscripts. The three most popular types of literature illustrated are saints' lives, didactic treatises, and medical treatises.

WILLIAM ROWE WEAVER. The *Curioso Impertinente* Theme in Spanish Dramatic Literature. (Under the direction of S. A. STOUDEMIRE.)

The purpose of this study is to trace the use of Cervantes' short story, *El Curioso Impertinente,* in the Spanish theater. The study contains fifteen plays dating from the early Seventeenth Century up to the present time. They are divided into two groups. The first, numbering eight plays, deals with unmarried couples. These plays are comic and follow the theme less faithfully. The second group is concerned with husbands and wives. These plays are tragedies, with one exception. They follow the plot of the short story too closely, character analysis being neglected. The plays are arranged chronologically and analyzed with special attention to similarities of plot details, use of Cervantine figures of speech, and variations in characters. The dramatic technique of each author, the varying interpretations of the underlying philosophy, and the introduction of modern devices have been noted.

DEPARTMENT OF RURAL SOCIAL-ECONOMICS

S. H. HOBBS, JR., is making a study of The Cost of Government in North Carolina.

He has edited the University News Letter, carrying economic and social studies of concern to the people of the state.

He has also directed the research work of the North Carolina Club. Due to lack of funds, the Club Year-Book will not be published this year.

Tennessee: Economic and Social, by C. E. ALLRED and associates, is practically completed.

South Carolina: Economic and Social, by S. M. DERRICK, will likely be completed during the year. The above studies are under the general direction of S. H. HOBBS, JR., and will be published by the University of North Carolina Press.

J. H. WORKMAN. School Transportation in North Carolina.

This comprehensive study deals with the history of school transportation in North Carolina; the present system in North Carolina and in other states; and presents a proposed new system for North Carolina. Directed by S. H. HOBBS, JR.

PAUL W. WAGER has published:

Reorganizing County Government to Meet Changing Rural Needs. *Proceedings* of the Institute of Public Affairs, Athens, Georgia, 1934.

Revision of Tax Delinquent Lands. *Proceedings* of the Conference of the National Tax Association, Boston, Mass., Oct. 1-4, 1934.

For two months in the summer of 1934 PROFESSOR WAGER was employed in the Bureau of Agricultural Economics, U. S. Department of Agriculture, Washington, D. C., to assist in analyzing and interpreting farm tax delinquency data.

Since August 15th he has been Regional Assistant of the Fourth District, Land Policy Section of the Agricultural Adjustment Administration. The chief activity of this section is the so-called Submarginal Land Program, which consists in the acquisition of land too poor for agricultural use and the resettlement of the farmers who have been attempting to cultivate it on good soils.

The following master's thesis was accepted by the Department during the year:

DONALD STUART MATHESON. Farm Movements in North Carolina and Their Significance. (Under the direction of S. H. HOBBS.)

The Granger Movement immediately following the Civil War initiated a conscious and persistent attempt on the part of rural America to adjust itself socially and economically to the commercialized price and market regime. The expression of this attempted readjustment by class conscious farmers assumed the form of farm organizations. The prominent part played by North Carolina is recorded in the history of the Grange of 1870, the Farmers' Alliance of 1884, the Farmers' Union of 1919, the commodity Co-operatives of 1925, and the new Grange of the present. A comparative study reveals striking similarities of purpose and behavior which identify them all with the same movement. Their successes and mistakes, with their subsequent results, should provide a hopeful guide for North Carolina organizations of the future.

The following doctoral dissertation was completed during the year under the supervision of the Department:

WADE PHILLIPS YOUNG. A History of Agricultural Education in North Carolina. (Under the direction of S. H. HOBBS, JR.)

This study traces the historical development of agricultural education in North Carolina from Colonial times to the present. Available records indicate that informal education in agriculture began in North Carolina with the apprenticeship system as early as 1695. Abstracts of wills and inventories indicate that some parents wanted their children to receive a practical education.

Formal instruction in agriculture began in the institutions of higher learning. It was planned in 1792 to include agriculture as a part of the instruction offered by the University. When it opened in 1795 the presiding professor was required to deliver weekly lectures on that subject. In 1822 it was reported that some time was devoted to agriculture. In that same year Governor Holmes recommended that the Legislature provide for the teaching of agriculture at the University and for an experimental farm.

From 1854 to 1870 the University offered instruction in agricultural chemistry. Just after the Civil War the University was given the Land-Grant fund, which was lost by the Reconstruction Trustees through poor investments. The Legislature replaced the lost fund by certificates of indebtedness.

The Legislature authorized an industrial school in 1885 with agriculture included. Due to dissatisfaction with agricultural teaching at the University the farmers cooperated with the Watauga Club, and the Legislature of 1887 established a separate agricultural college and gave it the Land-Grant fund.

In 1792 the Legislature provided for the establishment of agricultural societies and fairs. These organizations were responsible for the development of farmers' institutes and were the first form of modern agricultural extension teaching. They did much to shape the form of popular agricultural education and to fashion and mold public opinion concerning it.

During the decade 1830-40 three denominational schools were established as manual-labor schools. They soon abandoned the agricultural feature and became literary colleges.

The Experiment Station, established at Chapel Hill in 1877, was moved to Raleigh in 1881. When the Agricultural College was established in 1887 the Experiment Station was transferred to that institution.

Agricultural instruction in the lower schools began in 1901. The law of that year requiring the elements of agriculture was never succesfully carried out. Agricultural instruction of less than college grade developed, however; first through boys' and girls' clubs promoted by the General Education Board; second through farm-life schools; and third through departments of vocational agriculture and home economics.

The farm and home demonstration work was started by the General Education Board in 1907. This developed into the Extension Service, promoted by Smith-Lever funds.

Among the denominational and private schools teaching agriculture and home-making are: The Asheville Farm School, The Home Industrial School, The Campbell Folk School, and the Country Life Academy.

The agricultural press began in 1809 when the Raleigh *Star* began a front page agricultural section. Soon other papers began similar columns. Before 1850 two successful attempts were made to establish a strictly agricultural journal.

Among the farmers' movements that have promoted agricultural education in North Carolina The Grange, The Alliance, and the Farmers' Union are outstanding.

DEPARTMENT OF SOCIOLOGY

HOWARD W. ODUM has published during the year:

Regionalism vs. Sectionalism in the South's Place in the National Economy. *Social Forces,* XII: 338-354. 1934.

The Case for Regional-National Planning. *Social Forces,* XIII: 6-23. 1934.

PROFESSOR ODUM is completing, under the auspices of the Social Science Research Council, the research project, The Southern Regional Study: the South's Capacity for Social and Educational Development. Most of the maps, charts and graphs, and tabular material have been completed and set up, and the manuscript is to go to press early in 1935. The completed work will be published under the title, *Southern Regions: An Introduction to Regional Analysis and Demography.* (See report in *Research in Progress,* 1933.)

PROFESSOR ODUM, in collaboration with HARRIET L. HERRING, has under way a study of A University and Its State: Three Decades of North Carolina, 1900-1930.

PROFESSOR ODUM has been directing and supervising the following research projects:

JOHN BEECHER. A Cultural Study of the Birmingham Coal and Iron Regions.

GORDON BLACKWELL. Public Relief in the South.

JOHN MACLACHLAN. Analysis of the Socio-economic Characteristics of Mississippi.

Commercial Fertilizer in the Economy of the Southeastern Region.

Agricultural Readjustment with Special Reference to the Dairy Industry in the Southeast (in collaboration with HOWARD W. ODUM).

EMILY STEVENS MACLACHLAN. Higher Standards of Food Consumption in the Southern Region.

HELEN IRENE MCCOBB. Regional Folkways. (Progress on doctor's dissertation.)

LYDA GORDON SHIVERS. Social Legislation in the United States with Special Reference to the Southern Region. (Progress on doctor's dissertation.)

With KATHARINE JOCHER and others, he is continuing the studies of folk-regional society.

During the year, PROFESSOR ODUM has edited for the American Social Science Series published by Henry Holt and Company:

America's Social Morality. Dilemmas of the Changing Mores. By James Hayden Tufts.

PROFESSOR ODUM has also edited Volume XII of *Social Forces.*

HAROLD D. MEYER, with the Recreation Committee of the North Carolina Conference for Social Service, is making a study of Recreational Activities and Facilities made possible to the communities of the State through the various Federal services.

PROFESSOR MEYER, as State Program Chairman of the North Carolina Congress of Parents and Teachers, planned the yearly program for 1934-35, printed and distributed by the State Congress.

He is continuing his work on the book, *The Sociology of Leisure Time.*

He has edited for the Extra Curricular Library, published by A. S. Barnes and Company, *Character Education* by F. F. Powers.

LEE M. BROOKS has published:

A Decade of "Planning" Literature. *Social Forces,* XII: 3. 1934. (With EVELYN C. BROOKS.)

PROFESSOR BROOKS has in progress:

A study in racial-social distance, ready for publication.

He is continuing studies of attitudes and problems connected with the adoption of young children; of primary group isolation; community studies centering upon rural tendencies in the use of leisure.

For reports of the research activities of the following, see section entitled, "Institute for Research in Social Science," pp. 96-99:

ERNEST R. GROVES. Marriage, the history and conservation of the family, social psychiatry.

T. J. WOOFTER, JR. The Tennessee Valley Study, Subregions of the Southeast, the FERA and agriculture.

GUY B. JOHNSON. Effects of the depression upon the Negro in North Carolina, the Negro and the New Deal, racial attitudes, the participation of the Negro in southern life.

RUPERT B. VANCE. Regionalism, social demography, human geography, the problem of submarginal land, the southern farm-tenant and agricultural readjustment, political leadership and folk society in the South.

The following master's theses were accepted by the Department during the year:

GORDON WILLIAMS BLACKWELL. State Public Welfare in the Southeast: An Approach to Regional Planning in the Field of State Public Welfare. (Under the direction of HOWARD W. ODUM.)

First, a theoretical discussion of the development of the regional planning concept is presented. Functions of planning in the field of public welfare are then pointed out. The dynamic aspects of the project become revealed in a regional analysis of state public welfare, followed by a rather detailed presentation of state systems of public welfare and state emergency relief agencies in the South. An approach to planning is attempted in the formulation of a model system of public welfare for the southern states. This is not intended as a Plan to be adopted by all states in the South but should serve in a suggestive capacity in aiding various states to increase the efficiency of their public welfare administration, thereby making more effective their welfare services. The study is concluded by pointing out public welfare deficiencies in the individual southern states, with suggestions as to how these may perhaps be remedied.

JUNE RAINSFORD BUTLER. A Study of Some Reformatory Systems for Women Offenders in the United States, with Particular Reference to the Industrial Farm Colony at Kinston, North Carolina. (Under the direction of LEE MARSHALL BROOKS.)

Literature leads one to believe that since the beginning of civilization the woman offender has been present in society. The development of adequate treatment for women offenders in Europe and the United States has been slow, but the last thirty years have brought some important changes in some fundamental concepts regarding reformation of offenders.

Those who have given study to penal institutions believe that women's reformatories are the best and most progressive in this country, and that they are rich in possibilities of treatment of delinquents. It is difficult to estimate the exact population in women's reformatories, though it is comparatively small. There are twenty-one institutions in nineteen states which give evidence of doing some effective and worth while work, though the need for further research to test reformatory methods is great. No longer can treatment in reformatories be based on precedent and age-long prejudice; here, as in other institutions of society, it must be based on the findings of science.

JOHN BALLENGER KNOX. Recreation in Penal Institutions: A Survey of the United States with Special Emphasis upon North Carolina. (Under the direction of HAROLD D. MEYER.)

Historical consideration of methods of dealing with offenders indicates that in the past principles of revenge and deterrence have been the bases of punishment. In contrast, modern penology is based upon individual treat-

ment of the offender. In institutions observing this basic principle recreation should assist in the satisfaction of physical and psycho-social desires of the individual and in the development of normal desires in abnormal cases.

Many institutions, still guided by principles of the past, are not organized upon the principle of individual treatment. Study of recreational provisions indicates that time devoted to recreation is insufficient; that institutional expenditure per inmate for recreation is much less than the expenditure of persons at large; that adequate recreational and library facilities are not provided in many cases. Consideration of recreation in North Carolina institutions reveals that they are above the average in only a few respects and below in a great many.

SARAH MARGARET SMITH. A Social Study of High Point, North Carolina. (Under the direction of L. M. BROOKS.)

This study attempts to present a picture of the life of this city, the elements that have been woven into the making of the community pattern throughout the years, and the social forces at work in the community. It has been written with the activities of women and girls in mind especially, because it is expected to serve as a fact basis upon which future recommendations may be made to the High Point Young Women's Christian Asociation, in regard to trends in program planning, in the light of community needs and resources as revealed in the study. Those phases of community life which have been discussed in the chapters of this study are: Geographical Location, Historical Background, Physical Problems of Growth, Population, The City Government and Political Situation, Economic Aspects of the Community's Life, Labor Organizations, Banking, Hotels, Men's Civic and Commercial Clubs, Educational Agencies, Churches and Religious Attitudes, Social Agencies, Delinquency and Crime, Health and Leisure Time Activities.

The following doctoral dissertation was accepted during the year by the Department:

PAUL WALBERT SHANKWEILER. A Sociological Study of the Child Welfare Program of Worcester, Massachusetts. (Under the direction of ERNEST R. GROVES.)

The purpose of this thesis is to ascertain by statistical and case study and survey methods the social adequacy of the welfare organization for handicapped children in a Massachusetts city typical of northeastern industrial centers in its preponderantly foreign population and sharply contrasting culture patterns. As background for the study, a comparison of Worcester with other large cities in the state is made to determine its status with reference to standards of living and general welfare conditions. Analysis and evaluation of the community's child-helping organizations on the basis of nationally approved standards comprise the main body of the investigation, special attention being given to the family and neighborhood backgrounds of the clientele. The program is considered according to the four types of children dealt with: the dependent, the delinquent, the defective, and the normal.

Outstanding in the work of agencies contacting dependent children are the following facts: (1) the greater efficiency of private over public administration, and of non-sectarian over religious; (2) the evidence of cultural lag in the persistence of costly orphanage care alongside more economical and superior foster home care; (3) the greater demoralization of the large family, and the incidence of misconduct rather than sickness or death as the primary parental factor necessitating extra-familial care for children.

Protective work for delinquent children is deficient principally in respect to court location, superficial investigations, unscientific attitudes, and occasional use of the county jail for detention. The typical juvenile offender in Worcester is a fourteen year old boy from a slum area, retarded in school, relatively unsupervised in his play and reared in an immigrant home disorganized by cultural conflict, outside employment of mother, and a large family membership.

The treatment of defective children is likewise largely a public responsibility. The extensive nature of City Health Department activities, involving examinations revealing two-thirds of pre-school children to be unfit for school work, indicates growing recognition of the need for social medicine. Failure to discover in time the mentally defective pupil and a lack of follow-up work constitute the two weakest points in the school's mental hygiene program. The supplementary service of a state-operated Child Guidance Clinic is valuable but reaches comparatively few of the community's problem children.

In the preventive work of educational and character-recreational agencies for the normal child certain discrepancies between aim and practice are revealed: (1) girls not only leave school at an earlier age than boys but have only a third their opportunity for organized leisure activities; (2) youth in the downtown foreign areas have less chance of entering high school or joining the "Y" and "Scouts" than youth in the outlying residential sections; (3) playground records present the anomalous condition of the largest attendance rate in the area of greatest juvenile delinquency.

Until greater attention is directed toward removing the underlying causes of child need in Worcester—low living standards, unassimilated immigrant groups, parental ignorance and inadequate educational and recreational facilities—the community's work with children will continue on a salvaging rather than on a preventive basis.

DEPARTMENT OF ZOOLOGY

H. V. WILSON has completed:

(With IRENE BOLIEK.) Degeneration Phenomena in Sponge Larvae. *Journal of the Elisha Mitchell Scientific Society,* XLIX: 26-27. 1933.

The syncytial interior of the larva breaks up under adverse conditions into free rounded cells, more often with distinct ectoplasmic membranes. This behavior may provisionally be looked on as adaptive.

Cell Behavior in the Metamorphosis of the Halichondrine Sponge Larva. Paper read before the North Carolina Academy of Science, May 5-6, 1934. (In press, *Journal of the Elisha Mitchell Scientific Society.*)

PROFESSOR WILSON is directing the following research:

IRENE BOLIEK. (Progress on doctoral dissertation.) Studies on Syncytia in Sponge Larvae and Lymph Plasmodia of Sea-urchins.

R. E. COKER has published during the year the following papers:

Influence of Temperature on Size of Freshwater Copepods (Cyclops). *Internationale Revue der gesamten Hydrobiologie und Hydrographie,* 29 Bd.: 406-436. 1933.

Inverse correlation of sizes of certain species of copepods with the temperatures at which the copepods are reared is demonstrated experimentally for the first time. The influence of temperature is such that, for one species at least, there was practically no duplication of sizes in temperature classes 10-12° apart and none whatever in classes 20° C. apart, and this notwithstanding the occurrence of a considerable degree of individual diversity in size within the temperature class and a good deal of variation in the food supplies of the copepods. Reduction of food supply even to an extreme had a relatively small influence on size but greatly prolonged the period of development. In these copepod size is primarily a function of temperature, and doubtless of heredity in part, rather than of quantity of food.

Some Aspects of the Influence of Temperature on Copepods. *Science,* 79: 323-324. 1934.

A summary treatment of the results of breeding experiments with copepods at different temperature levels, with respect to size, form, development and toleration of high temperature.

Nearly related copepods differentiated physiologically as well as morphologically (*Cyclops vernalis* Fischer, *C. venustoides, n. sp.,* and *C. exilis,* no. sp.). *Journal of the Elisha Mitchell Scientific Society,* XLIX: 264-284, 1934.

It is attempted to clear up the confusion that has existed with respect to the relationship of some of the various forms of copepods in the *viridis-vernalis* group, employing the results of breeding experiments as well as observations on wild copepods from North Carolina and from the vicinity of Paris, France. Positive confirmation is given to the opinions of others who, on the basis of morphological observations, have proposed the elimination of certain specific names. The conclusions of another investigator, who has also employed breeding experiments, are partially confirmed and supplemented. An American copepod that differs from *vernalis* in some structural characters and, more markedly, in its response to conditions of temperature is described as a new species. Another copepod, which has few but distinct structural characteristics, and which could not be bred in the laboratory under conditions favorable to the other species, is likewise described as new.

Influence of Temperature on Form of the Freshwater Copepod, *Cyclops vernalis* Fischer. *Internationale Revue der gesamten Hydrobiologie und Hydrographie,* 30 Bd.: 411-427, 1934.

When copepods of certain species reared at low temperatures are compared with those reared at high temperatures, distinct differences are found with respect to the proportions of the furca. There were indications also of a tendency to increase in the number of spines on the exopod of the fourth foot and the substitution of a spine in place of the seta on the terminal segment of the endopod of the same foot, the stronger spination being much more common at low temperature.

In the course of the year a South American journal republished a paper by R. E. COKER originally printed in Spanish in 1907. This paper, entitled "La caza de labos en el Perú," appeared in the *Boletín de la Compania Administradora del Guano,* IX: 8, 1933.

The paper embodies the results of studies of the interrelations of sea-lions and guano-producing birds along the coast of Peru. It was originally published in the *Boletín del Ministerio de Fomento,* V (12): 64-95. 1907.

C. D. BEERS has published:

The Relation of Density of Population to Rate of Reproduction in the Ciliates *Didinium nasutum* and *Stylonychia pustulata. Archiv fuer Protistenkunde,* LXXX: 36-64. 1933.

This study was undertaken to ascertain whether an allelocatalytic effect (acceleration of the rate of reproduction induced by the presence of a second individual or additional individuals) characterizes the reproductive activities of *Didinium* and *Stylonychia.* Different numbers of washed specimens of the two ciliates were isolated into different volumes of culture fluid and their reproductive rates were recorded at regular intervals. Under the experimental conditions employed, there was no evidence of an allelocatalytic effect.

PROFESSOR BEERS is completing for publication a study of certain cytological changes which accompany the process of encystment in the ciliated infusorian *Didinium nasutum.*

IRENE BOLIEK has completed:

Syncytial Structures produced by Lymphocytes of Sea-urchins. Paper before N. C. Academy of Science, May 5-6, 1934. (In press, *Journal of the Elisha Mitchell Scientific Society.*)

The following doctoral dissertation was accepted during the year by the Department:

EZDA MAY DEVINEY. The Behavior of Isolated Pieces of Ascidian (Perophora viridis) Stolon as Compared with Ordinary Budding. (Under the direction of H. V. WILSON.) Published in the *Journal of the Elisha Mitchell Scientific Society,* XLIX: 185-224. 1934.

Isolated pieces of stolon when transforming into ascidiozooids depart from the morphogenetic method employed in budding. The departure is greatest in quite short pieces (1mm. or less in length). In these the septum as such is scarcely recognizable. Remnants of it together with mesenchymal plates and masses combine to form an endoblastic vesicle in direct fashion, with no formation of new tissue. The process is one of morphallaxis and is obviously adaptive. The formative elements are the cells of the septum and the similar undifferentiated cells of the blood stream.

The following master's theses were completed during the year under the supervision of the Department:

H. H. ADDLESTONE. Influence of Temperature on Form and Development of *Daphnia longispina.* (Under the direction of R. E. COKER.)

The form of the head of *Daphnia longispina* at birth was found to be governed by the temperature prevailing during development, the critical temperature being at about 14-16° C. Breeders kept at lower temperatures yielded round-head young, those kept at higher temperatures yielded pointed-head young; mixed broods of round-head and pointed-head young were obtained from a few breeders kept at about the critical temperature. By transfer of gravid breeders from one temperature chamber to another at different stages in the incubation of eggs in the broodpouch, it was found that the critical period in development (as regards influence of temperature on form of head) was at or about the time of hatching, which occurs in the broodpouch very early in the period of incubation. The same parent could be induced to produce alternate broods of pointed-head or round-head young by appropriate transfers from one temperature level to another. Correlation of rate of development with temperature was noted.

J. W. CULBERTSON. Effect of some Physico-chemical Changes in the Environment on Embryo-formation in the Frog. (Under the direction of H. V. WILSON.)

A study concerned with early teratomata. Solid blastulas approaching the meroblastic type of ganoid fishes (Amia); oedematous blastulas with large, nearly central cavity, approaching the Amphioxus type; blastulas with roof formed of a single layer of cells, are described along with early stages in gastrulation. The inference is drawn that in respect to the materials passing into the early organ primordia, these teratomata exhibit differences from the normal.

INSTITUTE FOR RESEARCH IN SOCIAL SCIENCE

Substantial grants from the Laura Spelman Rockefeller Memorial and the Rockefeller Foundation made to the University of North Carolina, for the study of problems in the social sciences arising out of state and regional conditions, led to the establishment in 1924 of an Institute for Research in Social Science. The work of the Institute

represents, therefore, a specific program of regional social research, study, and interpretation, with studies in local government, southern historical backgrounds, socio-economic activities (including studies in social-industrial relationships), crime and criminal justice, the Negro, folklore and folk backgrounds of the southern people, social institutions, public welfare and child welfare, and human geography of the American South. While chosen for the most part from the state and regional field, research projects are selected with a view to their generic value and for their possible contribution in both method and content.[1]

For a report of the research activities of HOWARD W. ODUM in the Southern Regional Study: the South's Capacity for Social and Educational Development, to be published early in 1935 under the title, *Southern Regions: An Introduction to Regional Analysis and Demography,* and studies of folk-regional society, see section entitled "Department of Sociology," pp. 88-89.

ERNEST R. GROVES has published during the year:

Sex in Childhood (with GLADYS HOAGLAND GROVES). New York: The Macaulay Company. 1933.

The American Family. Philadelphia: J. B. Lippincott Company. 1934.

PROFESSOR GROVES has completed the manuscript on Mental Hygiene.

He has edited the following:

Education for April, 1934.

For Longmans Social Science Series:

Immigration. By Lawrence Guy Brown. (1933)

Criminology. By Albert Morris. (1934)

T. J. WOOFTER, JR., has published the following:

The Tennessee Valley Regional Plan. *Social Forces,* XII: 329-338. 1934.

The Subregions of the Southeast. *Social Forces,* XIII: 43-50. 1934.

In connection with the Southern Regional Study, DR. WOOFTER has completed the Tennessee Valley Study—a critique of the relation of the TVA project to the balance of the South.

[1] For a further statement regarding the establishment and the purposes of the Institute and for book lists of publications, see *Research in Progress,* 1928-1929, pp. 95-97; 1929-1930, p. 80; 1930-1931, p. 89; 1931-1932, p. 90; 1932-1933, p. 81.

This work was extended in the fall with CWA personnel to cover phases of TVA activity which may affect North Carolina such as tenancy, local government, public opinion, student occupations, recreational facilities, and submarginal lands.

DR. WOOFTER has served on the Social Science Research Council Committee on Agriculture.

He is chairman of the Committee for Organizing FERA rural research in North Carolina.

CLARENCE HEER served as research consultant of the American Legislators' Association and Research Director of The Interstate Commission on Conflicting Taxation, from June 1933 to June 1934.

DR. HEER, in cooperation with the Commission of Inquiry on Public Service Personnel, has under way researches in the changing status of public employment, a statistical study of trends in the size, function, occupational distribution, and compensation of the public service group.

HARRIET L. HERRING has published during the year:

The Industrial Worker. Chapter XVII in *Culture in the South.* A symposium edited by W. T. Couch. Chapel Hill: University of North Carolina Press. 1934.

Some Costs of Economy in Schools. *Social Forces,* XIII: 85-91. 1934.

During the winter of 1933-34, MISS HERRING assisted in directing studies made in cooperation with the TVA on the Centralization of Public Education in North Carolina by MABEL BACON and W. H. E. JOHNSON; in surveys of tenant farm families by GORDON W. BLACKWELL and field assistants; in a study of the North Carolina Legislature of 1933 and State Issues by IRENE STRIEBY.

MISS HERRING has also completed a study of Salaries and Living Costs of the Teachers in North Carolina, comparing 1929-30 and 1933-34, as one unit in the study of A State in Depression.

MISS HERRING has under way and will complete other units of the State in Depression study begun last year, particularly a study of suicides in North Carolina, 1929-1933.

She is directing a study of leisure time activities of mill workers under the NRA by Frances Hampton.

In collaboration with HOWARD W. ODUM, MISS HERRING is carrying on a study of A University and Its State: Three Decades of North Carolina, 1900-1930.

MISS HERRING is completing her history of the textile industry in the South.

KATHARINE JOCHER, with HOWARD W. ODUM, is continuing the studies of folk-regional society.

DR. JOCHER has assisted in editing Volume XII of *Social Forces.*

GUY B. JOHNSON has published during the year:

The Negro and the Depression in North Carolina. *Social Forces,* XII: 103-115. 1933.

DR. JOHNSON has completed his researches on the Negro and the Depression in North Carolina.

In cooperation with the Commission on Interracial Cooperation, DR. JOHNSON has made a survey of the effects of the New Deal on Negroes in the cities of Durham, Greensboro, High Point, and Winston-Salem.

DR. JOHNSON is supervising a study of the participation of the Negro in southern life, under the auspices of the Commission on Interracial Cooperation.

He is undertaking researches into the attitudes of the Negro members of the North Carolina Commission on Interracial Cooperation.

DR. JOHNSON has edited the *Bulletin* of the Archaeological Society of North Carolina.

GUION GRIFFIS JOHNSON has, during the year, completed the following chapters of her Social History of Ante-Bellum North Carolina: The Slave System, Social Life of the Slave, The Free Negro, Poor Relief, Reform Movements, and Sanitation and Health.

RUPERT B. VANCE has published during the year:

Aycock of North Carolina. *Southwest Review,* XVIII: 288-306. 1933.

What of Submarginal Areas in Regional Planning? *Social Forces,* XII: 315-329. 1934.

Human Factors in the South's Agricultural Readjustment. *Law and Contemporary Problems,* I: 259-274. 1934.

Braxton Bragg Comer: Alabama's Most Audacious. *Southwest Review,* XIX: 243-264. 1934.

The South's Profile. Chapter II in *Culture in the South.* A symposium edited by W. T. Couch. Chapel Hill: University of North Carolina Press. 1933.

With WALLER WYNNE, JR., Folk Rationalizations in the "Unwritten Law." *American Journal of Sociology,* XXXIX: 483-492. 1934.

DR. VANCE, in cooperation with the Commission on Interracial Cooperation, is completing his study of the Landlord-Tenant Relation in the South and the Plight of the Southern Farm Tenant in Agricultural Readjustment.

DR. VANCE has under way a consideration of the concept of regionalism in its relation to social and economic planning.

He is also investigating the function of government aid in helping tenants to own farms. This is a comparative study of foreign experience with special reference to tenancy in the cotton belt.

DR. VANCE is continuing research on:

1. Southern folk leaders in politics in the post reconstruction period. The volume planned has the tentative title, Statesmen and Spellbinders of the New South, 1880-1930.

2. Theoretical considerations of regionalism, social demography, and human geography.

3. Problem areas, types of farming, and human factors in relation to the concept of submarginal land.

JULIA CHERRY SPRUILL is completing her volume on Women in the Southern Colonies, which will be ready for publication sometime during the coming year.

EDWIN M. PERKINS has published during the year:

Tax Injunctions and Suits to Recover Taxes Paid under Protest in North Carolina. *North Carolina Law Review,* 12: 20-42. 1933.

The Sales Tax and Transactions in Interstate Commerce. *North Carolina Law Review,* 12: 99-119. 1934.

The Power of Congress to Levy Taxes for Distribution to the States. *North Carolina Law Review,* 12: 326-349. 1934.

MR. PERKINS has under way the following research projects:

Ten Years of the Federal Estate Tax Credit Clause.

The Measure of Chain Store Taxes.

Extraterritorial Factors in the Measure of State Taxes.

HERSHAL L. MACON has published during the year:

Severance Taxes in Alabama. *The Tax Magazine,* March and April, 1934.

DR. MACON has completed a study of the administration of the North Carolina Sales Tax.

The study is concerned with the law and the rulings of the commissioner of revenue relating to the sales tax and the efficiency of the administrative practices. The sales tax laws and their operation in other states will be summarized for purposes of comparison.

ROBIN HOOD has published during the year:

A Bibliography on Southern Labor. *Social Forces,* XIII: 133-137. 1934.

MR. HOOD, under the direction of H. D. WOLF, D. D. CARROLL, and HARRIET L. HERRING, is completing his annotated bibliography on southern labor since 1865.

The bibliography is arranged under thirty-seven major topics subdivided by general, state, and sub-topic, based upon official state and federal government publications and reports, laws and court decisions, dissertations and theses, books and investigations, learned journals, popular magazines, pamphlets, and newspapers.

He has under way a study of southern labor standards to be completed in 1935. This is an investigation of wages, hours, occupational distribution, and working conditions by sex, race, and age in the twelve southeastern states since 1880.

MR. HOOD is investigating wages, hours, total and monthly employment, seasonal industries, and the percentage wages of manufacturing costs in North Carolina as assistant to H. D. WOLF, executive secretary, the North Carolina Unemployment Insurance Committee for its Report on a Social Insurance Program for North Carolina to the 1935 General Assembly.

H. M. DOUTY has under way a study of the North Carolina Industrial Worker, 1880-1930.

A study of the labor factor in the rise of industry in North Carolina, including consideration of industrial growth in the state, labor supply, wages and hours, working and living conditions, trade unionism, social legislation.

M. T. HORNE, JR., has been carrying on, under the direction of C. T. MURCHISON, a study of savings in the South.

The purpose of the study is to show the trend since 1918 of the dependence of the South upon outside capital by comparing investments with savings in the region.

B. B. Kendrick, Jr., under the direction of C. T. Murchison and J. B. Woosley, is studying the marketing of flue-cured tobacco.

A socio-economic study of the market forces in this field, necessitating some consideration of production and, to a lesser extent, of manufacture and sale.

David A. Lockmiller is completing his study of the Second United States Intervention in Cuba, under the direction of W. W. Pierson.

A history of the activities of the United States in Cuba from September 29, 1906, to January 28, 1909, with special emphasis on the administration of the provisional governor, Charles E. Magoon.

RESEARCH ORGANIZATIONS.

PROCEEDINGS OF THE ELISHA MITCHELL SCIENTIFIC SOCIETY

October 10, 1933, to May 8, 1934

346th Meeting, October 10, 1933

C. D. Beers: *Population Studies in Infusoria.*

Published in full in *Archiv fuer Protistenkunde,* Vol. 80, pp. 36-64, 1933, under the title "The Relation of Density of Population to Rate of Reproduction in the Ciliates *Didinium nasutum* and *Stylonychia pustulata,*" which see.

W. deB. MacNider: *The Resistance of Fixed Cells to Injury.* (Lantern.)

347th Meeting, November 14, 1933

The Society celebrated the fiftieth anniversary of its founding at a special meeting held in Gerrard Hall with Dr. J. W. Lasley, Jr., presiding. The program follows:

Archibald Henderson, Kenan Professor of Mathematics: *A Sketch of the History and Achievements of the Society.*

Published in full in this issue.

W. C. Coker, Kenan Professor of Botany: *Publications and Exchanges of the Society.*

Ivey F. Lewis, Miller Professor of Biology, University of Virginia: *Adaptation, The Fourth Property of Protoplasm.*

Published in full in this issue.

348th Meeting, December 12, 1933

J. M. Valentine: *Environmental Response and Evolution in Ground Beetles (Carabidae).*

Field studies in western Europe and northern Africa under diverse ecological and climatic conditions have yielded data of some value in determining the direct or indirect effect of radiant energy (light and heat) upon the coloration of carabid beetle populations.

Deficiency in either heat or light inhibits pigmentation, portions of the body, such as the legs and elytra where the chitin is weakest, often

remaining pale or piceous. Complete depigmentation occurs only in subterranean and cavernicole types.

As available radiant energy is increased, there seems to be a critical point at which full pigmentation is allowed but at which no stimulus is offered for the evolution of a microsculpture capable of diffracting light. Insects subject to these conditions are, for the most part, strictly nocturnal species hiding in dark places by day and are black.

Correlated with a greater exposure to the sun's energy, and with the choice of progressively more open habitats, a long series of corresponding color stages may be assembled, from the dark metallic and dull parti-colored forms of crepuscular habits, concealed in the forest by day under loose cover, to the brilliantly hued species active in the open sunlight.

A broad consideration of these tendencies has led to the theory that adequate radiant energy above a certain critical point is necessary for the full release of the genetic potential stored within the race. Carrying this idea little further, it is suggested that the relatively great diversity in form and color characteristic of tropical insects is the result of an actual stimulating effect which mutational forces sustain in environments reached by the equatorial sun.

The release of genetic potential has been found to be by no means a random affair. Wherever an environmental factor, such as a homogeneous substratum, is found to be predominant, it becomes indirectly reflected in the appearance of the carabid population inhabiting that ecological frame. The result is convergent evolution. It is thought that all problems of parallelism including mimicry and insular convergence have, fundamentally, a great deal in common, though no analysis of the factors involved has yet proved satisfactory.

T. F. HICKERSON: *Continuous Beams and Frames: A New Method of Analysis.*

349TH MEETING, JANUARY 9, 1934

H. D. CROCKFORD: *Some Problems in the Operation of the Lead Storage Cell.*

W. F. PROUTY: *Mineral Resources of the Tennessee Valley Region.*

The basin of the Tennessee River drains practically all types of rock areas in the five physiographic provinces which it traverses. It thus has a great variety of soil, topography, climate and mineral products.

In the Blue Ridge physiographic province it possesses the greatest variety of minerals in association with the igneous and metamorphic rocks. Here, chiefly in North Carolina and Georgia, we have the greatest known feldspar—kaolin—mica deposits associated with the pegmatites. This area leads the world in the production of feldspar and the United States in the production of mica. It is fast becoming a leader in the production of high grade ceramic materials. Magnetic iron ore, together with chromium, nickel and copper ores, are found in considerable quantites in this area. Many rare and semi-precious minerals are also associated with the numerous pegmatites.

The Appalachian Valley Province with its stratified sedimentary rocks has a large variety of useful minerals in workable quantities. Barite, so much used for paint, occurs in large deposits in Virginia, Tennessee, North Carolina, Georgia, and Alabama. Bauxite, the chief ore of aluminum, is also found in workable quantities in several places in Tennessee, Georgia, and Alabama. Both limonite and hematite, ores of iron, are widely distributed and have furnished raw materials for iron manufacture in a number of places as at Rockwood and Chattanooga. The zinc deposits are especially well known in the valley northeast of Knoxville. This area has been a heavy zinc producer for many years. Some of the less valuable zinc deposits will be buried in the reservoir created by the Norris Dam. The marble deposits about Knoxville lead the world in marble production.

The Cumberland Plateau Province is almost entirely underlain by coal deposits and fire clay. The coals are of greater thickness and better quality in the northern portion of Tennessee and adjoining Virginia areas and again toward the south in the Warrior Coal Field of Alabama. In some localities of Tennessee and southeastern Kentucky there are workable deposits of both petroleum and natural gas.

In the Interior Plains Province of Central Tennessee and Kentucky are located the great brown, blue and white phosphate deposits which yield, next to the Florida deposits, the largest production in the United States. On the south side of the Tennessee Valley in northern Alabama and in the Bowling Green area of Kentucky are vast areas of rock asphalt deposits much used throughout the country in road construction. Near the mouth of the Tennessee River in Kentucky and across the River in Illinois are found the greatest known fluorite deposits of the world. These deposits are accessible to both water and rail trans-

portation. Manganese, bauxite, oolitic limestone, and brown iron ores are also to be found in important deposits in this province.

The Tennessee Valley occupies a portion of the Coastal Plain Province in North Carolina, Mississippi, Western Tennessee, and Southwestern Kentucky. In this area occur large quantities of very high grade clays, including the "ball" clays so much used in the ceramic industries, vast gravel deposits which have been shipped for many years from northeastern Mississippi to many parts of the United States, and bauxite deposits extending down into eastern Mississippi of considerable importance.

It would be very difficult to find an area equal to that of the Tennessee Valley anywhere in the world which contains as many different types of mineral deposits of as great importance to civilization as are to be found in this one watershed. The term which has sometimes been applied to the Tennessee valley as "the American Ruhr" seems justified.

W. F. PROUTY: *Carolina Bays.*

The elliptical depressions locally called "bays" in the Carolinas have been studied in recent months by W. F. Prouty, G. R. MacCarthy and J. A. Alexander of the Department of Geology, University of North Carolina, under the research fund of the Rockefeller Foundation. A careful study of all available maps shows a vast number of these elliptical depressions having the same direction of elongation and apparently the same mode of origin. The areas in which these depressions are most abundant are the Coastal Plain portions of the Carolinas and northeastern Georgia. There are a few scattered depressions as far north as southeastern Virginia. These bays are best shown on aerial photographs but their presence is indicated on many topographic and some of the soil survey maps. Other soil survey maps have not the slightest indication of their presence, although hundreds of these depressions, of as much as one-half mile diameter, are known to occur in the area of such a map. It is thought that a number of the lakes in North Carolina, as, for example, many of those in Bladen County, have the same origin as the elliptical bays.

The chief purpose of the survey was to determine, if possible, the origin of these bays. Careful magnetic studies have been made on a number of these bays in different parts of the area. The bays near the coast were found to have very small magnetic anomalies but some

well inland show sufficiently large anomalies to warrant the possibility of a buried meteoric body below and to the southeast of these depressions. Further work on this problem is anticipated. While there is a general uniformity in the direction of elongation of the elliptical depressions, there seems to be a tendency for those toward the north to have more of an east-west trend, while those to the south may have more of a north-south trend, thus indicating what might be expected from a flock of meteoric bodies,—a slightly radial distribution due to the increased air resistance in the front of the swarm. The conclusion is reached that the origin of these bays is meteoric although this origin cannot as yet be absolutely proved.

350TH MEETING, FEBRUARY 13, 1934

E. S. BARR: *Infra-red Study of Some Inorganic Acids.*

A. M. WHITE: *The Power Consumption of Agitators.*

To appear in the Transactions of the American Institute of Chemical Engineers, 30: under the title "Studies in Agitation, IV and V."

351ST MEETING, MARCH 13, 1934

J. U. GUNTER: *Anatomy of Venous Valves.*

In this paper a survey of the literature dealing with venous valves was presented. The history, physiological significance, embryology, gross and microscopic anatomy, variability, and distribution of the valves in the human body were considered. The object of this study was to attempt to determine whether mechanical factors or whether hereditary factors were more important in causing valves to develop in veins. It is a significant fact that valves are always absent in certain veins particularly those of the trunk, and are always present in certain others. Several hypotheses for the formation of venous valves were presented, but none was proved.

R. E. COKER: *Reactions of Copepods to High Temperatures.*

Copepods of three species, *Cyclops viridis* Jurine, *C. varnalis* Fischer and *C. serrulatus* Fischer, have the capacity of assuming at high temperatures a condition of deathlike dormancy and of making apparently complete recoveries from several successive dormancies. The critical temperature for dormancy varied from about 30° to about 38.5° C., depending to some extent upon the individual but chiefly

upon the temperature at which the copepod had developed. There seems to be physiological differences between copepods reared at low temperatures (about 9° C.) and those reared at higher temperatures (up to 29° C.)—differences that persist in spite of adult experiences with reference to temperature.

352ND MEETING, APRIL 10, 1934

E. N. KJELLESVIG: *Trenton Foraminifera from New York.*

See abstract in "Preliminary List of Titles and Abstracts" of papers presented at the 46th annual meeting of the Geological Society of America, Chicago, 1933, p. 75.

OTTO STUHLMAN, JR.: *Electrodeless Discharges in Gases.*

Hydrogen was excited as an electrodeless discharge in a high frequency electrical field. A 2 cm. cylindrical electrodeless tube was placed coaxially in a solenoid excited by a dynamically balanced push-pull oscillator. Frequency range 5.0 to 7.5 mega-cycles. Power supply range 10 to 100 watts. Pressures near 250 microns. Intensity of the alpha and beta lines was determined photographically. At constant power input and constant gas pressure the intensities per unit field strength were found to be proportional to the frequency of the oscillating electrical field.

$I_\alpha/\beta I$ is equal to 0.976 at 60 watts, 0.986 at 70 watts, and 1.05 at 80 watts.

353RD MEETING, MAY 8, 1934

COLIN CARMICHAEL: *Heat Transfer from Internal Combustion Engine Cylinders.*

The gas film which adheres to the inside wall of an internal combustion engine cylinder offers a high resistance to the flow of heat and effectively protects the wall material from the high flame temperatures attained during combusion, provided a sufficient flow of heat is maintained.

An analytical study based on the Kinetic Theory of Gases and Dimensional Analysis shows that the film coefficient of heat transfer is affected by viscosity, density, specific heat and velocity of the gases inside the cylinder. When the first three variables are expressed in terms of temperature and pressure changes the probable limits of variation during a cycle are determined.

Numerical values of the coefficient for any engine or type of engine under any conditions must be determined by experiment, and it is proposed to base calculations on the average temperature throughout the cycle and on the average rate of heat transfer. This is necessary since it is not possible to follow the rapid temperature changes during a cycle inside the cylinder with any existing instruments, and the rate of heat transfer from the cylinder can only be found by measuring the cooling water flow over a finite period of time.

Experiments conducted on a gasoline engine show the effect on the heat transfer coefficient of changes in spark advance, air-fuel ratio, speed and throttle opening. It is concluded that turbulence and high pressure are chiefly responsible for high values of the coefficient, while the presence of carbon deposit decreases the coefficient.

J. W. LASLEY, JR.: *Recent Developments in the Differential Geometry of Plane Curves.*

The following officers were elected for the year 1934-1935:

President—G. R. MacCarthy.

Vice-President—R. W. Bost.

Secretary-Treasurer—E. W. McChesney.

Dr. E. T. Browne was elected Permanent Secretary of the Society. The editors of the Journal, W. C. Coker, H. V. Wilson, and Otto Stuhlman, Jr., continue in office.

The following resolution was submitted.

James Munsie Bell died March 3 at Clearwater, Florida. To his bereaved family the Elisha Mitchell Scientific Society extends its very deep sympathy. We, too, are bereaved of a friend, and are acutely sensible of the loss of an investigator, scholar, teacher, and administrator, who attained rare success in each of these fields; who united with the attributes required for these successes, a broad interest in science other than his specialty, wide culture, bibliographical skill, and an unending enthusiasm for the interests of this Society. As Permanent Secretary for years, he labored steadfastly for the enhancement of its prestige, its usefulness, and whatever appeared as its interests. Our indebtedness to him can never be repaid, but we gratefully acknowledge it.

Dr. Bell was born at Chesley, Ontario, Canada, in 1880. At the University of Toronto he received his A.B. in 1902 and his A.M. three years later. He was Sage Fellow at Cornell University and received

his Ph.D. in 1905. For the next five years he worked at the U. S. Department of Agriculture on physico-chemical problems in the genesis of soils, reclamation of alkali soils, and fertilizers, the results of these researches being recorded in a number of governmental publications and journal articles. Coming to Chapel Hill in 1910, he later published the results of investigations on the heat capacities and other properties of the nitrotoluenes, on concentration cells, free energy and heat capacities, copper salts, and other problems of more transitory interest. He is more widely remembered perhaps by his work on the compounds of zirconium, part of which was done in collaboration with Dr. Venable. In collaboration with Dr. Paul M. Gross he published a widely used text book on physical chemistry. Called to head the Department of Chemistry in 1921, he further assumed the duties of Dean of the School of Applied Science in 1929, and throughout these succeeding years he was an active member of various administrative and other faculty committees. Dr. Bell was a member of the leading chemical societies, the North Carolina Academy of Science, Sigma Xi, Alpha Chi Sigma, and was Permanent Secretary of the Elisha Mitchell Scientific Society.

In 1909 Dr. Bell married Miss Mary E. Brawner, of Georgetown, D. C., who survives him, as does his mother, Mrs. Hannah M. Bell of Toronto, Canada.

Your committee offers this statement as a resolution, to be spread upon the minutes of the Society with instructions to the Secretary to forward a copy to the bereaved family.

JAMES B. BULLITT,
FRANK K. CAMERON,
ALVIN S. WHEELER.

THE PHILOLOGICAL CLUB

OCTOBER 9, 1933

R. B. SHARPE. Shakespeare and the Turning of the River Trent; a Topical Allusion.

This paper points out that Shakespeare in *The First Part of King Henry the Fourth,* III, i, 97 ff., may be referring to an actual diversion of the river Trent, a riotous event which, by the time the play was written a couple of years later, had become nationally notorious by involving the Privy Council and the greatest nobles and the most serious political issues of the time.

A. K. SHIELDS. Melodrama on the Madrid Stage in the Early Nineteenth Century.

NOVEMBER 10, 1933

PROFESSOR WALTER G. FRIEDRICH, Johns Hopkins University. Shakespeare and the School of Night.

DECEMBER 4, 1933

PROFESSOR HANS KURATH, Brown University. The Formation of the Linguistic Atlas of America.

JANUARY 6, 1934

VAN COURTLANDT ELLIOTT. Some Aspects of the Literary Criticism of Pliny the Younger.

FEBRUARY 7, 1934

J. C. LYONS. The Black Arts in 16th Century French Literature.

In an age in which the modern scientific viewpoint was born, it would be logical to suppose that any belief in the once popular pseudo-sciences of alchemy, magic, sorcery, divination, and allied subjects would disappear before the advancing current of rationalistic thought.

In this paper the author endeavors to examine statements of prominent men of letters of the period to determine to what extent the above supposition is true. From this evidence it would appear that only the most advanced thinkers of the age rejected the traditional beliefs, and that the great majority of even the intellectuals still had faith in the powers of the black arts. It can be assumed that the faith of the masses of the people was but slightly shaken.

The author hastens to add that he has only scratched the surface of the available evidence in this paper, but believes that further investigation will serve to confirm the conclusion that he has reached.

MENO SPANN. Tendencies in Recent German Literature.

The Hitler Revolution means also a revolution in German Literature. The fundamental tendency is not new. It is the old German revolt against the Spirit of Rationalism, the "Western" Spirit. The attempt to make German Literature truly German again is akin to the Spirit of Storm and Stress, and Romanticism. On the other hand, there is much of cheap middle-class conservatism and blunt reactionary resentment in this purgatory process. A definite judgment of how German Literature will develop in the future cannot be given. All that one can say is that for the years to come it will be mystic, romantic, even rustic. No internationalism, Marxism, or even urbane liberalism will be tolerated.

MARCH 15, 1934

A. C. HOWELL. Tennyson's "Palace of Art" Revisited.

This paper attempts to show the close connection existing between "The Palace of Art" and Tennyson's own experience in Cambridge University. It departs from the orthodox interpretation, i. e., that "Art cannot live divorced from the life of the common herd," and works out, from statements in the poem and outside evidence concerning Tennyson's life at the University, the suggestion that "The Palace of Art" is Tennyson's allegorical way of saying that he was dissatisfied with what he had gained from his stay there and was not sorry to put off his college robes.

N. B. ADAMS. The Madrid Stage in the Year 1837.

The year 1837 marked the culmination of the Romantic drama in Madrid. Plays which suggested certain aspects of Romanticism had been shown from the Siglo de Oro onward, and especially since 1834, but they did not dominate until three years later. After 1837, there was a tendency towards a greater eclecticism, and after 1850 a far greater proportion of realistic plays.

The study was based on lists of plays performed in Madrid 1820-1850 in the possession of members of the Spanish faculty of the University.

APRIL 8, 1934

G. C. TAYLOR. Milton and du Bartas.

MAY 15, 1934

PROFESSOR W. S. KNICKERBOCKER, University of the South. Scholarship in a World of Chaos.

SOCIETY OF THE SIGMA XI

The principal activities of the Society of the Sigma Xi during the year were as follows:

The first meeting was addressed by DR. R. E. COKER on the subject: "Rearing Copepods under Different Temperatures."

The second meeting was held jointly with the Duke University Chapter. DR. F. K. CAMERON spoke on the subject: "An Unrecorded Adventure in Industrial Chemistry."

The annual lectures were delivered by DR. HUGH S. TAYLOR of the Department of Chemistry of Princeton University. His first lecture was on the subject: "Recent Developments in the Study of Reactions at Surfaces." The second lecture was on the subject: "The Use of

Heavy Hydrogen in Problems of Reaction Mechanism at Surfaces and in Homogeneous Systems."

The final meeting was addressed by DR. W. A. PERLZWEIG, his subject being: "Undergraduate Preparation for Professional Training."

During the year five members were advanced from associate to full membership. Fourteen were admitted to associate membership.

RESEARCH PUBLICATIONS

JOURNAL OF THE ELISHA MITCHELL SCIENTIFIC SOCIETY

Volume XLIX, 1—September, 1933

Proceedings of the Thirty-second Annual Meeting of the North Carolina Academy of Science.

Proceedings of the Elisha Mitchell Scientific Society.

Early Man. *J. B. Bullitt.*

Abnormal Dentition in Rays, Batoidei. *E. W. Gudger.*

Modern Zoögeography. *Z. P. Metcalf*

Occam's Razor and Mendel's Peas. *J. P. Givler.*

Notes from Ten Years of Bird Study at Greensboro, North Carolina. *Earl H. Hall.*

Parasites and Commensals of North Carolna Crayfishes. *Sally Anderson Allen.*

A Development Study of Dumortiera hirsuta (S.W.) Nees. *Paul M. Patterson.*

Pleurotus tremulus Fr. and Secotium conicum n. sp. from Tennessee. *L. R. Hesler.*

Basidia of Septobasidium (Glenospora) Curtisii. *John N. Couch.*

Sexuality of Allomyces arbuscula Butler. *Winslow R. Hatch.*

Wind and Sand Injury to Leaves and Fruits. *R. F. Poole.*

Fatal Poisoning with Sodum Nitrate. *H. B. Arbuckle and O. J. Thies, Jr.*

Removal of Manganese from Public Water Supplies. *E. E. Randolph.*

A Photographic Method of Collecting References. *Theodore B. Mitchell.*

Volume XLIX, 2—April, 1934

The Behavior of Isolated Pieces of Ascidian (Perophora viridis) Stolon as Compared with Ordinary Budding. *Ezda May Deviney.*

The Old Field Prisere: An Ecological Study. *W. M. Crafton and B. W. Wells.*

The Siphonaptera (Fleas) of North Carolina, with Special Reference to Sex Ratios. *Archie D. Shaftesbury.*

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